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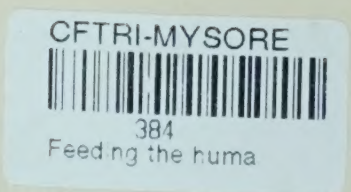

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Chapter One

FOOD AND THE HUMAN BODY

THIS is the story of man's insatiable stomach ; and when I say *man* I mean all mankind spread over the face of the earth and increasing from generation to generation. Whatever philosophies men may create, they must first eat and they must always eat. So conscious of this were they in the past, that all their religion and morals have been woven primitively from the substance of seed-time and harvest.

Now that we know the meaning of a world famine, we need perhaps a new morality or a return in new guise to the primitive and sensible morality of our forefathers. But our mode of thought to-day is scientific ; and it is only in terms of science that we can express our convictions and our hopes. This, then, is a scientific work. That is to say, it contains a series of ordered facts and figures. But none of the figures quoted have been selected without good reason ; they are all worth pondering, because they will be all found to carry a weight of significance. Together the facts and figures have been so arranged, as slowly to reveal the pattern of human existence as we know it. Let us begin our scientific inquiry and follow whither it leads us.

Science has studied the feeding of *men* as individuals for about a century and a half ; it has only just begun to study the feeding of *mankind* as a whole. This is not merely a process of multiplying the food needs of one human being by the number of people on the face of the globe. On the contrary, the problem is a very complex one and must ultimately involve an inquiry into all human affairs, social and economic.

Now, economics and political theory are not perhaps strictly sciences ; they are commonly held to be matters of opinion. But where they merge with the accepted forms of scientific research to present us with a single problem in human destiny, they must necessarily pass, so to speak, into a new

dimension. They must become matters for precise scientific analysis.

We are all of us very much concerned with the problem ; but for what reason ? Use what argument you will : that a hungry world is not likely to be a pacific world, that food is the first necessity of life, that the earth is the Lord's and the fullness thereof. There is an element of truth in all these arguments. But anyway, who of us can find rest to-day except in the effort to build a happier world ? We have to plough and cook and eat, when all is said and done ; and in my view a stable civilization will from now onward be built only upon the foundations of the farm and the kitchen.

Before I begin my wider survey, it would be as well for us to consider briefly *why* it is that we eat food at all. There is no purpose to be served in dealing with the subject at great length. All I shall attempt to do is to present the physiologist's view of the matter ; for the physiologist's view is naturally the starting point of our whole argument.

We eat and enjoy very diverse kinds of food. If man was not, from the time when he first emerged upon the earth, an omnivorous animal, heaven knows where he acquired the habit. He shares this habit with the rat, another creature with a genius for surviving and for colonizing remote parts of the earth's surface. For our normal purposes we take a very simple view of the foods we eat. At the worst they serve to satisfy a bodily craving, that we call hunger ; at the best they can be so prepared and mixed together, as to become one of the pleasures of civilized life. But when we take a detached view of the matter, we realize that eating is merely part of an unending process, merely a part of the flow and interchange of substances within the body, that is the very essence of being alive. Why *do* we consume food three or four times every day ?

Man did not begin this habit of consuming food ; and we need not pause to consider whether Nature could have achieved her end in any other manner. It suffices only that she does thus achieve her end, that of keeping the organism alive. Every cell in an organism is itself a living unit. The cells are composed into tissues and the tissues into bodily organs, and connection between them all is maintained by a continuous

interchange of substances, constructing and resolving and reconstructing the pattern we know as life. The medium in which the substances pass from cell to cell is mainly water ; and it is as well for us to realize the humbling fact that some 70 per cent. of our bodies is composed of this fluid. Water is, in a way, the most essential of all our foods. But the solid or what we may call the dry matter of our food, most of which passes in solution out of our digestive tract to become, for longer or shorter periods of time, assimilated into the changing substance of our body, has strictly two main purposes for being there at all. I keep to this definition of the two purposes of food, though it is perhaps quite arbitrary to suggest that there are two distinct purposes ; it is at no time possible to distinguish completely between them, in the sense in which the fuel and the spare parts of an internal combustion engine, for example, are obviously distinct. We may, however, make the distinction, because it is possible to conceive that creatures could have come into existence, that used one kind of food for one purpose and another kind of food for the other.

Let us now examine the first of the two functions performed by our food. The substances that compose our muscles, bones, blood and so forth are far from simple ; and, since all these tissues have their own internal work to do within the body's economy, it follows that the chemical interchanges that are always in process among them, are naturally also of an incredibly complex character and that they require at every stage to be influenced and directed by living substances that are no less complex. One might suggest indeed that a fairly large part of the more stable fabric of our bodies is composed of *enzymes*, that is to say, complex but definite substances that continuously assist in directing this process of building up and resolving and rebuilding the tissues. But it must be remembered that we are here dealing with the utterly minute and often momentary changes that take place within the living material. To permit this organic flux to go on within our tissues, we have to derive a regular income of fresh substances from our food, since there is naturally a continuous wastage of the used up material. In any one day or week we do not necessarily require a very large amount of food ; but what we do consume must contain all the elements, in due proportion,

that we happen to need ; and, moreover, they must be in the form in which we happen to need them. Every species of animal has its own peculiar modes of digesting and utilizing the substances of its food ; and it follows that it must have food of the kind and in the form it needs ; it will otherwise suffer from some dietetic deficiency or even from pure starvation.

Before we examine further this primary function of food, as restoring constantly the more permanent fabric of the body, we may touch briefly upon its other main purpose. The distinction, as I say, is an arbitrary one, but useful in the context. Get this quite clear : food is eaten simply as *fuel*, as the source from which the organism derives its *heat* and *energy*. Actually this is the more obvious function of food, at all events once we have grown accustomed to think in terms of modern machinery. For it is rather doubtful whether this idea of fuelling the body would have been clear to a man before the machine age. At the most he would have said that something he called his *strength* was failing him for lack of food ; but why the lack of food should have this effect on him, he probably did not pause to consider. By far the larger proportion of the solid matter we consume is used as *fuel*. Storage of it in the tissues may, of course, take place for a longer or shorter period in the form of fat and sugar. But ultimately this storage matter is used up. If the creature is well fed its stores are constantly replenished ; but where it is deprived of food, it necessarily falls back upon its reserves of fat and may survive for some time, though at last in a painfully emaciated condition.

As for the manner in which the substance of the food is finally converted into warmth and energy, it is precisely the same as with any other type of fuel combustion. That is to say, oxygen derived, of course, from the air we breath combines in the tissues with some of the carbon compounds from the food to form carbon dioxide ; and this gas together with water vapour is in turn expelled by the lungs. It is all a process of slow combustion, enabling the body as a whole to maintain the energy needed for its vital functions. When no daily income of food is provided, the body first falls back, as I say, upon its reserves of fat ; and it subsequently begins to deplete the substance of the muscles themselves, in its unavoidable

THE APPROXIMATE AMOUNT OF HUMAN ENERGY IN THE WORLD AS DRAWN FROM VARIOUS FOODS

FOOD	GRAIN	VEGETABLES AND FRUITS	SUGAR	MILK	MEAT	FISH
PERCENTAGE OF TOTAL ENERGY DERIVED.....	72	12	6	5	4	1

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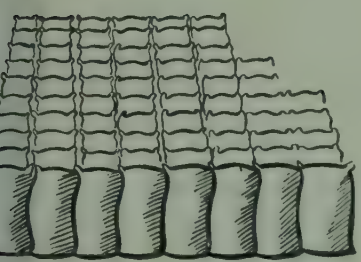

GRAIN

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VEGETABLES AND FRUITS

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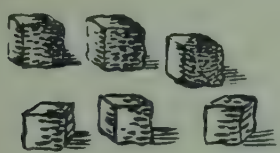


SUGAR

5.o

MILK

4.o

MEAT

1.o

FISH

need to obtain warmth and a modicum of energy, even if that energy be only sufficient to maintain the heart beat, the respiration and the other basic processes of living. But where there is a normal income of food, no such exhaustion of the body's reserves is necessary.

All foodstuffs are by their nature a store from which energy and warmth may be derived by the organism. If they are digestible and are not poisonous, they will support life with greater or less efficiency. The real problem arises when we consider that the relatively stable structure of our bones, muscles, nerves and internal organs has to be maintained from a supply of *more specialized and often very complex substances*, which must also be derived from the food. Here, as you see, we are reverting to the primary purpose of eating. It is fairly obvious, for example, that the hard matter of our bones and teeth is fashioned from lime salts in association with phosphorus, and that these substances must somehow be absorbed by the body. On the other hand, the mass of such soft tissues as muscles is based upon the very complex organic substance called *protein ;* and by no means all the foodstuffs we consume supply the constituents of this *protein* in the forms we need, while such foods as do supply the essential constituents vary widely in the extent to which they give the body a chance of securing precisely what it requires for its growth and maintenance. A diet can thus be definitely very poor in its provision of *protein* material, just as a soil may be poor in its capacity for providing plant nutrients. Vegetation on such a soil will be often weak, sickly or stunted. We differ, of course, from the plants in that we are so fashioned that we can use for our sustenance only the animal or vegetable substances already elaborated ; but the principle remains the same. A poor diet is as ineffectual as a poor soil and must result in bodies that are weak, sickly or stunted. They are not machines fit to utilize to the full the energy derived from their food.

The problem for the body fundamentally is this : to what extent is it able to synthesize the fairly simple materials, into which it has broken down and dissolved the foodstuffs during the process of digestion, so as to produce the far more complex substances that it has to assimilate for its own use ? It can do so to a remarkable extent, as can the plants with the simple

naterials they derive from the air and the soil. But there are nany feats of synthesis that the body cannot effectively per- orm ; and every species of animal has its own peculiar powers nd weaknesses in this direction, that are the heritage of a ong process of evolution. Certain chemical *elements*, of ourse, the body requires, as, for example, the *calcium* that is he basis of lime salts for the structure of the bones and the *ron* that happens to be a necessary constituent of the red blood ells that carry oxygen and carbon dioxide to and from the issues. Mineral elements of this kind cannot be synthesized, nowever small be the amount the body daily requires ; they nust be obtained from the food.

But a more interesting feature of the problem is the body's almost complete inability to synthesize a few complex substances that enter into the composition of human protein, and a number of the chemical agencies that promote the intricate series of changes from cell to cell. Such indispensable parts of the vital structure of our tissues have to be secured from the food, more or less in their original complex state, and in that state they have to be assimilated and used. It is to some of these essential substances that the term *vitamins* has been temporarily applied as a convenient label. The vitamins are very diverse both in their chemical composition and in their function. But they have one characteristic in common ; they are essential in the body's economy and yet the body itself cannot manufacture them from simple materials. When they are deficient, a serious disturbance may emerge in the body, leading ultimately to death ; and this, together with the fact that they may be poorly provided in a low and monotonous diet or a diet composed of highly processed foods, has made vitamins very much the concern of the modern doctor.

Why it is that the human body fails to synthesize precisely such substances as it does fail to synthesize, is a problem for those who study the course of animal evolution. We can for the moment only accept matters as we find them. There are, for example, certain of the vitamins, that men and monkeys alone, with a few other species, seem incapable of synthesizing ; on the other hand, there are certain substances that men seem able to dispense with or are capable of synthesizing in the minute quantities required by them. We are thus under the

curious and disconcerting necessity of securing several chemical compounds from our food, whether we term them *vitamins* or in other cases, essential constituents of human *protein*.

As I have said, a poor diet may be deficient in these substances or in some of them almost to any extent ; and it is here that the idea of a *balanced* diet begins to emerge. I shall not trouble to explain the idea of a properly balanced diet in terms of protein, vitamins and mineral salts. For all practical purposes it is quite sufficient that a diet should be ample, varied and palatable. It must be ample in quantity, because an average man would need at least two or three pounds of assorted food daily ; and it must be varied, because the more varied a diet is, the more likely it is to provide all the substances the body can possibly need.

I return in this way to the remark I made originally, that the kinds of food we normally eat are very diverse. They certainly are. We have only to consider the range covered by bread, meat, milk, green vegetables, rice and eggs. At all events most men will adopt such a diet if they have the chance. It is varied enough to satisfy fairly well the ideals of the physiologist ; and that is all we ask of any diet. Our first task as scientists is to see to it that the whole human race has at least as balanced a diet as this would imply. Whether we like it or not, we all have for our health and survival to consume a varied diet ; and since varied food happens also to be the only decent basis of a civilized fare, we shall probably not complain that it is necessary for us. Failure to secure a reasonably balanced diet means, in brief, the ultimate failure of the human machine to function either in part or as a whole.

Chapter Two

SEAS, SOIL AND FAMINE

IT is said that there are rather more than 2,000,000,000 people on the earth. We can estimate how much food they require by taking the needs of a single man as a basis and

making some allowances for age and climate. If we find that we are by all estimates producing less food in the world than we need, we must make good the deficiency and the only way we can do it is to grow more crops and breed more stock.

The vegetation of the earth, which we either consume direct or process into meat and milk by feeding it to livestock, grows almost exclusively in the shallow layer of soil that covers a large part of the land surface. Man thus depends ultimately upon the soil for the greater part of his sustenance. The proportion he derives from the seas and the inland waters is still negligible. No one knows precisely how much fish is consumed annually by the human race. But one surmise reaches a figure of about 16,500,000 tons. We may, if we wish, increase this estimate by 25 per cent.; and even in that case we should still have to conclude that only 1 or at most 2 per cent. of the whole daily output of human energy is derived from the fish we eat. In some regions, of course, the proportion is considerably higher; the Japanese, for example, are estimated to have obtained in normal times some 5 per cent. of their daily energy from fish. But this implies an exceptionally high level of consumption. The value of fish as a *protein* food is, however, more obvious; for the average Japanese fish has probably been the source of almost 20 per cent. of his protein; and even for the world as a whole the proportion of protein supplied from fish may be as high as 6 per cent. It is certainly a great advantage to a community to be near good fishing waters. It has been remarked that in Africa the best nourished peoples are often those living beside lakes and rivers and consuming the fish they find in them.

But for at least 98 per cent. of our daily energy and 94 per cent. of our protein we depend upon the *soil*. One may doubt whether any of Nature's gifts, over which we have some measure of control, demands more serious attention than does our soil. Our reserves of coal and petroleum are being gradually exhausted and can never be replaced; but if atomic power is to be at our disposal, this burning away of our capital resources becomes of little importance. Once the surface layers of soil, with their vital water-holding capacity, have been carried away by floods or winds, the vegetation can no longer find support or nourishment. Soil erosion of this kind is the one thing

above all others of which man should have a care. The nutrient properties of a soil may be exhausted by bad husbandry and overcropping ; but that is of little moment, provided the substance of the soil itself remains unimpaired ; its fertility can be restored by scientific manuring and cultivation. For soil erosion there is no immediate remedy. We can only conserve the partially eroded land by measures of flood control, reforestation and selective stocking.

The vegetable crops we grow from the soil are, as I say, either consumed by man or fed to his stock for conversion into meat, eggs and milk. It may not greatly matter in the long run whether these animal foods form a large or a small proportion of a man's diet ; but the principle that a diet should be varied seems to imply that an American, who derives 30 per cent. or more of his daily energy from foods of animal origin is likely to be better fed than a Chinese peasant whose fish or eggs provide him with no more than 2 or 3 per cent. So poor a diet is obviously far too close to the margin of safety. Moreover, we might as well admit to ourselves once and for all, that dainty fare is one of the decencies of civilized life. Seven pounds of potatoes and a pint of milk a day compose, it has been said, an almost perfect diet. It is useful to know this ; but I doubt whether anyone is justified in prescribing such a diet, unless he is prepared to submit to it himself.

Now, when a scientist has to estimate how far the food available in any given country falls below the needs of its population, he invariably states his conclusion in terms of milk, meat, green vegetables and so forth. How he selects his list of foods is another matter. Usually he makes some attempt to allow for the traditional habits of the people and the existing limits of production. But he estimates for a well-varied diet, because he is aware that the constituents of the various foods conveniently supplement one another and provide between them all that the body needs. There is no help for it. The country has to be reckoned as deficient in so many million gallons of milk and so many hundred thousand tons of meat.

In other words, what we are aiming at is not merely a world with a sufficiency of rice or potatoes to forestall the pangs of hunger, but a world that is *well nourished ;* and a well-nourished world is one in which a variety of vegetable and

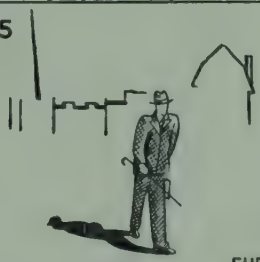
TOTAL POPULATION AND PERCENTAGE OF POPULATION IN THE DIFFERENT CONTINENTS

CONTINENT	ASIA	EUROPE	NORTH AMERICA	AFRICA	SOUTH AMERICA	OCEANIA
POPULATION (IN MILLIONS)	1.154	574	184	157	89	11
PERCENTAGE OF TOTAL POPULATION	53.0'	26.5	8.5	7.5	4.0	0.5

53.0

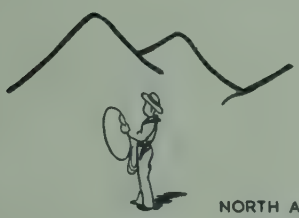
ASIA

26.5



EUROPE

8.5



NORTH AMERICA

7.5

AFRICA

4.0

SOUTH AMERICA

0.5

OCEANIA

animal foods has become available to all its citizens without distinction of race, colour, class or nationality.

A certain quantity of rice or potatoes consumed daily will prevent starvation but not malnutrition ; and we ought perhaps at this stage to make one or two qualifying remarks. The human race may as a whole have been underfed ; but it has not died out. True, there have been famines ; and, unless we change the direction of our policy, there will presumably be more famines. But unnecessary as such a wastage of life may be, the race still survives and breeds ; and surely we may now ask ourselves whether it is so much the pure wastage of human life that concerns us, as the stunting and warping of the bodies and minds of the countless millions, who insist on surviving through it all. The fact is that most of our fellow men do not, biologically speaking, become completely *men* in the sense in which most rabbits, say, if the herbage is plentiful and they are spared a violent death, become completely and biologically *rabbits*. Mankind has thus to be measured by its food supply ; and the measurement is ultimately expressed in terms of lowered vitality, subnormal health, failing stamina and a needless contraction of the span of human life.

Yet famines have been common enough, even in the last few generations ; and they have not invariably come as the aftermath of war. According to one estimate the famines in India alone, and over the last quarter of the 19th century alone, resulted in a matter of 26,000,000 deaths. Such a record imposes upon us the absolute duty of looking first to the production and storage of the familiar grain and root crops. It is, indeed, as well that we should recognize that the vast populations of Eastern Asia, at least 50 per cent. of the human race, are permanently haunted by the fear of famines. For China as a whole we probably possess no complete figures. A survey made a few years before the war and based on such evidence as could be obtained suggests that few of the administrative areas, into which the country was divided, had not some experience of famine conditions within human memory. On an average each of these areas had suffered from three periods of famine within a generation, though they had been more frequent in the wheat regions of the north than in the rice regions of the south. In the north, again, the cause had usually been a

severe drought, while in the south the damage was mainly due to the less frequent but no less disastrous floods. The duration of the famines, too, had varied somewhat ; on an average they persisted for a year among the wheat-consuming populations, whereas among the rice-eaters recovery was in most cases more rapid. It is, however, with the effect upon the people themselves that we are most concerned. The figures cannot be very accurate ; but they are the best indication that we have. It is said that on an average in such a famine 13 per cent. of the population sought safety by migration, 24 per cent. were reduced for a time to eating bark and grass, while 5 per cent. starved. The highest level of starvation, of which we have record, was one of 43 per cent.

Some relief measures were, of course, attempted ; but they were usually inadequate. In only two out of every three of the famines experienced by an area was any relief organized. In the years that preceded the final Japanese invasion matters had improved somewhat, because the more complete integration of the country had made it possible to import food supplies from beyond the area affected. Yet the policy that will have to be adopted in the future if the country is to be preserved from famines is of a far more drastic nature. Productivity will have to be so far increased, that there is a margin for storage ; and the transport facilities between area and area need to be improved. In the north particularly drainage systems will have to be developed on a large scale both to conserve water against periods of drought and to carry off the excessive rain that occasionally falls. The vast river basins require schemes of flood control and extensive measures of irrigation.

It is not easy to describe the nature of a famine. I am not sure that it can even be imagined. The social conditions of famine are much the same, wherever it occurs ; and as I study the accounts of eye-witnesses I believe the only way of conveying a true impression is that of the composite picture drawn from diverse countries. Let it run on in a continuous flow like a film, merging from scene to scene. The very confusion of scenes reflects the utter bewilderment and misery of the disaster.

The ground is too hard to plough in Hunan. There is

going to be a famine. Even if it rains within the next month, there is bound to be a famine. We walked across the fields with Father Fidelio. Fields? They were more like a desert. Parched, yellow, cracked, they stretched for miles in all directions. In all that vast area not one man was at work. With his plough immobilized and the ground too hard for the hoe, the farmer is helpless. If only he had a spade. Less thirsty crops than rice could be planted. But there are no spades, no seed, no desire to try out anything new . . . In Kwangtun province I saw people eating up the seeds for the very crop that might help them, and others who could not wait for the harvest but dug up the crops while still half-grown, in order to live a little longer. The people first sold their personal effects, then furniture and household effects; when these were gone, they sold tiles from their roofs, windows, window frames, even floors plank by plank. Thousands of homeless ones sit on street kerbs or by the roadsides, staring vacantly, taking little or no notice of passers-by. The women seem to last longer than the men, who use up their energies more quickly trying to find their families . . . In a suburb of Toishan an elder said that the death rate of women was so high, that only one woman was left to every twenty children. Hundreds of half-naked, pot-bellied orphans sit in doorways, begging piteously or scavage garbage heaps. . . Within the length of several miles I counted on the banks not less than five hundred skulls and skeletons. Too many people had died in too quick succession for the relatives to be able to cremate the dead . . . I saw in practically every house benches covered with birch or lime leaves. These are dried, pounded, mixed with acorns, some dirt and water and then baked into a substance which they call bread, but which looks and smells like baked manure. The children cannot digest this food and they die. The mothers have no milk and pray that death may come quickly; slow starvation is too painful. 90 per cent. of the children between one and three have already died from the famine . . . I had occasion to-day to pass by the cemetery. For weeks unburied corpses have lain there, frozen into the semblance of huge bundles of faggots in which haggard faces and shrunken limbs can gradually be distinguished. Many of these famine victims, it was easy to see, had died of actual starvation; for whether young

or old they seemed to have no flesh at all, only skin-like parchment drawn tightly over the bones . . . I have seen children with eye infections derived from malnutrition, their eyes puffed out the size of eggs and exuding pus in streams an inch wide down their cheeks. These children were one week from total blindness and perhaps one month from death . . . Banks of streams are lined with dead bodies abandoned by the river folk. It is estimated that in some places more than three fourths of the boat people perished, though accurate figures may never be known. Refugees from the famine shuffle painfully along the roads leading inland. Some of them are so far gone, that they quietly sink down and die by the roadside.

Does this give some faint impression of the horror of famine? If it does, then let us admit in the name of human decency that our first business is by all means to prevent starvation. But once we have admitted that, we may turn our attention to the real problem of the world's food deficiency. Reckoning our figures by a yard-stick applied to the needs of the average man and making some allowance for age, climate and mode of life, we find that on any of the estimates so far given the deficiency of food is a serious one. It is much less serious, of course, in grain products than it is in meat or vegetables ; were it otherwise, starvation would have been even more familiar to us than it is at present. But the grain deficiency is nevertheless impressive, because it would be impossible for us to increase the production of milk and meat, unless we had some reserves of grain for fodder. When the harvest of grain is only just sufficient for human needs, it is usually impracticable either to store against a shortage or to maintain a large head of stock.

Have we a text for our argument? I think we have. When the representatives of the United Nations met in Hot Springs, U.S.A. in the early months of 1943, they could go on record that " there has never been enough food in the world for the people of the world to eat. To provide the food needs of mankind will require a vast increase in food production in every land. Each country is faced with problems of underconsumption and malnutrition, problems which differ in severity in different regions but which in general are everywhere the same." Let us see what figures we can apply to this state-

ment. Where the scientists of any country reckon how far consumption ought to be raised, they usually base their figures on standards that are not strictly comparable with one another. It all depends at what level of consumption they are aiming. Thus, if we quote their figures, we shall only be giving a broad indication of the extent to which the production of various foods will have to be raised. The estimates refer, of course, to the *pre-war* standards of living.

It is interesting, then, to realize that even in the United States it has been reckoned that an adequate plan of consumption would require 4 to 8 per cent. more meat, poultry and fish, 15 to 25 per cent. more eggs, 30 to 40 per cent. more tomatoes and citrus fruits, 70 to 80 per cent. more milk and 125 to 150 per cent. more leafy vegetables. Such a proposal, if it were carried out, would absorb most of the available surpluses of food and demand some considerable expansion in production.

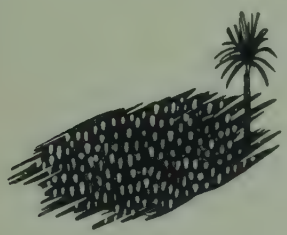
By contrast a National Nutrition Committee established in Hungary before the war came to the conclusion that the country's milk consumption would have to be increased by 120 per cent. and its egg consumption by 470 per cent. But for fresh vegetables an increase of only 20 per cent. was contemplated. In the opinion of the Committee this could be brought about in no way but by complete reorganization of farming. The war has at least begun the process of reorganizing Hungary's agrarian economy ; but it is still too early to say how soon the country will recover from the desolation into which it has fallen. Poor as are the living standards in a few of the south-eastern countries of Europe, they apply to relatively small populations ; and when the millions of Asia are taken into account, the yard-stick of measurement has to be more modest. It is only necessary to quote a single typical estimate for the world as a whole. An American economist has suggested that the world production of meat, fish and poultry ought to be expanded by nearly 100 per cent., that of vegetable oils by 125 per cent., that of milk and milk products by about 150 per cent., that of fruits and vegetables by over 300 per cent., and that of cereals by 50 per cent.

Let us accept these figures provisionally ; in one sense they appear somewhat conservative, though it does not affect the

PERCENTAGE OF WORLD ANIMAL FOODS PRODUCED BY CONTINENTS (REDUCED TO A COMMON BASIS)

CONTINENT	ASIA	EUROPE	NORTH AMERICA	AFRICA	SOUTH AMERICA	OCEANIA
PERCENTAGE OF ANIMAL FOODS	16	47	24	3	8	2

16

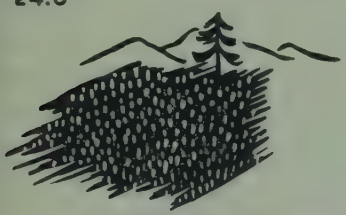


ASIA

47.0

EUROPE

24.0



NORTH AMERICA

3.0

AFRICA

8.0

SOUTH AMERICA

2.0

OCEANIA

argument if we choose to lower them by 20 or 30 per cent. On the assumption that the human diet ought to be composed of foods of this nature, there is one crop that has obviously been left out of the reckoning ; and that is the grass and clover crop that would be needed for the fodder of the increased herds. Some of the increased cereal crop would be absorbed in the same way, but by no means all ; only when the Asiatic dietary had been largely supplemented with fats, would it be safe to divert such a proportion of grain to the feeding of animals. While percentage figures of this kind remain no more than scientific guesses it is clearly useless to infer from them how extensive would have to be the changes in world farming. How much more land would have to be under the plough ? That naturally would depend on how far we can raise the yield per acre ; and this we know to be possible in many countries by good husbandry, irrigation and selection of seeds. How far should we have to increase our dairy herds ? That would depend upon our ability to raise the yeild of the average cow by careful breeding and stocking. Even in so advanced a country as our own it would probably be possible to raise the annual yield of milk by 40 or 50 per cent. without increasing the number of cows.

Let us, then, leave the percentage figures as a crude measure of the world's deficiency. Whether we select the foods mentioned or some other foods as necessary to the right feeding of the 2,000,000,000, it will still be true that production must be vastly increased. But the increase will be slow in many regions of the earth. It is an axiom of all good farming that the structure and the fertility of the soil must be preserved from year to year, whatever be the need for crops of wheat, rice or potatoes ; for the soil must serve not merely this generation of men but all succeeding generations. In this shallow layer of soil that covers the earth's surface lies the power of producing the vegetation that is ultimately the secret of our own survival. Properly tended it will do the work for us ; scientifically we learn more every year about its complex structure and its variability of composition ; but we must recognize that it is unstable in texture and liable with improper usuage to rapid and irremediable degradation. Good farming, however, needs good farmers ; and it is after all less the soil that counts (for

the soil when left alone can take care of itself), than the men who manipulate the soil as the basis of their subsistence or their livelihood.

Chapter Three

THE SWEAT OF MAN'S BROW

IT is less the soil that counts than the men who manipulate the soil as the basis of their subsistence or their livelihood. Our own country, however, has so abnormally small a proportion of its labour engaged in farming, that we scarcely realize how large a proportion of the world's energies is daily devoted to the task of producing food from the earth or the waters. According to the most recent figures we possess, about 6 per cent. of our own occupied population is in agriculture, whereas even our close neighbours, Belgium and the Netherlands, have usually some 17 and 20 per cent. respectively engaged in the same pursuit. As we move south and east into France and Germany we find that labour on the farms accounts for 30 per cent. or more of the occupied population. But when we reach the countries of the Danubian Basin and the Middle East the proportion of rural to urban population has risen vastly. They have twice, three times, or even four times as many people in their peasant as in their urban communities ; and probably 80 per cent. of the populations of the Far East may be reckoned as villagers.

While estimates may vary somewhat, it is usually agreed that at least 66 per cent. of the whole human race consists of food producers together with their wives and families. In other words, two out of every three of the world's inhabitants are still engaged exclusively in the task of keeping themselves and their urban neighbours alive. 66 per cent. of the available working energy that mankind has at its disposal is, we might say, daily devoted to the business of providing sufficient energy to enable us to carry out the next day's work ; and the next day's work is merely a repetition of the same process.

Our first conclusion must be that farming is still the most important occupation ; and, moreover, a relatively small proportion of the cultivated land is given over to crops other than food. But we may next be drawn into a mood of humility. Has civilization, then, only reached the stage where 66 per cent. of our total working energy has to be devoted daily to the elementary task of keeping body and soul together ? If that be so, surely our first object should be to release some of this energy for the production of all the other commodities that most of us still lack. It would be interesting to surmize on how small a labour force the world's food could be produced, if we used all the resources of modern science. But such a speculation would be mainly irrelevant. We are concerned here with feeding the world and not with the reorganization of its labour force.

My reason for dealing with the *production* of food is that the food producers of the world are usually far more conscious of their grievances as producers than they are of their needs as consumers. We must recognize that men think rather in terms of what they produce than of what they consume. It is around the processes of production that they organize their social life ; and it is rather by hunger for land than by hunger for food that the peasant is driven to revolt or migrate. As a result, economists and governments have been in recent years deeply concerned with the demands of the *food producers ;* that is to say, they have been primarily concerned that farmers and peasants should not be driven off the land, either by natural disasters or by a failure of the markets for their produce. It was, until the last decade or so, assumed that governments could on the whole do little to raise the level of *consumption* in the world or even within their own frontiers. The level of consumption, they believed, was regulated either by the level of wages and of farm prices, which must be left in the main to the free play of competition, or by the economic conditions of the countries overseas ; and these conditions were in any case beyond the control of the exporting country. In effect, while governments have certainly been intervening to influence the food markets, they felt that they could only do so by legislating in the interests of the *producers ;* and that is precisely the stage we had reached when the war broke out.

PROPORTION OF THE POPULATION ENGAGED IN AGRICULTURE
U.S.S.R. 65%
RUMANIA 66%
BULGARIA 80%
HUNGARY 51%
POLAND 66%
YUGOSLAVIA 66%
CZECHOSLOVAKIA 34%
AUSTRIA 26%
GERMANY 29%
SWEDEN 30%
NORWAY 31%
DENMARK 30%
HOLLAND 20%
BELGIUM 21%
FRANCE 35%
U.K. 6%
85C

It is necessary for us to be quite clear on this matter. We began by discussing the consumption of food and we have been led forward, through the irony of things, into a discussion on the farmer and all his complex problems. What excuse have we ? Well, for one thing, if we can raise the living standards of 66 per cent. of the human race, most of them will be better fed and the 33 per cent. of us, who do not work or live on the land will presumably benefit in some measure. But there is more to it than that. We must not look upon the food producer as an idealist. There is nothing to be gained by telling the peasant or the practical farmer that he should think less of the cash value of his products and more of the human value of a good diet ; he will be ready enough to think of human values when he is sure of a sound and, if possible, an expanding market and a reasonable guaranteed price. We have, then, to give the farmer some incentive if we are to have all the food we need. The physiologist can only indicate how far a country is deficient in the consumption of milk or meat or vegetables ; it is for the soil scientist and the agricultural economist to suggest how the deficiency shall be made good.

Now, most of the peasant producers of Africa and Asia are not even aware that a world nutrition policy is being discussed. But the farmers of the more advanced countries, who produce mainly for the market, see in a nutrition policy a useful method for increasing the sales of their products. They and their governments tend to support it for that very reason. It so happens that the policy coincides with their own interests ; and that gives them a very justifiable opportunity for talking about want and hunger and the need for an economy of abundance. We find in this the point of departure that we are requiring. We can all argue about the demands of the producer of food, whether he be peasant, farmer or plantation labourer ; and the upshot of it is that, as economists are now realizing, we can only think in terms of full consumption levels by turning the problem upside down and discussing less the consumption than the *production* and the *distribution* of food.

Our task is to make food available to the public. Very well. This is primarily a matter of production ; and production levels can only be raised if there is an effective market for the food. But that is precisely what the producers are

demanding, *an effective market for their food.* I shall examine later how closely the new international organization is related to the producing interests in various parts of the world ; but for the moment I may briefly summarize the problem as it presents itself. It is possible to solve the problem of agricultural distress in two alternative ways. We may tell the farmer that there is no hope of expanding the market for his products and that his only safety lies in producing a modest quota, for which he may be guaranteed a modest but not a starvation price. On the other hand, we may plan to develop his market for him and then, as he begins to respond to the increased demand, attempt to guide him along the channels of efficient farming. Both schemes can be made to work in some measure. The former was the solution usually tried in the decade before the war ; the latter was adopted in only a few countries and to a limited extent ; but it is obviously the most radical and thorough-going policy of the two.

In a sense the movement toward a well-fed world has been promoted mainly by economists and civil servants that represent the interests of men who produce for an overseas market. But we must remember that the soil chemist and the stock-feeding specialist are no less alive to the conditions of the Indian villager or the West African cropper than they are to those of the farmer in the Middle West or on the grazing lands of New Zealand. The conditions under which crops are grown or stock raised are very diverse ; and I must once again insist without excuse that our basic problem is whether the soil will continue to grow all the vegetation we require. We can no doubt do much to improve water supplies and to prevent flooding and soil erosion ; we can develop pasture lands and increase fertility ; ultimately we shall have some control over the climate. But from season to season we have to adapt our farming methods to the soil and the climate as we find them. It is thus a serious mistake to refer to farming as an *industry*, unless we are quite clear that its conditions differ in many respects from those of factory production.

Before the food can be produced in the quantities we require, we have to be satisfied that it suits the soil, upon which it is to be produced. That means that the primary concern of a government should be for the conservation of its soil ; and

for that purpose it must have farming and peasant communities who think as much of their soil as they do of their markets. In other words, it is only when a farmer has considered the health of his soil, as well as the prices he is likely to get for his produce, that his mind is free to take a humane interest in the hungry or ill-fed multitudes waiting for food. Fortunately there are signs that the world is beginning to learn this lesson. One of the perversities of the European mind over the last century, for example, has been the attempt it made to treat the veldt and prairie lands of the west and south when it reached them as though they were inexhaustible storehouses of fertility ; it applied to them the farming methods traditional in Europe, only on a vast scale ; and the result, had the practice continued, could have been disasterous. The soils of Europe require careful and laborious working ; and in the main they have received it. When men were released upon the fertile soil of the prairies, they believed that such soils could be cultivated in the old way but without the need of laborious conservation. What they did not then realize was that new lands have to be cultivated in ways specially adapted to the unfamiliar climatic and soil conditions.

The conclusion to be drawn is that we should think of our nutrition policy in terms that are comprehensible to the peasant and the farmer ; but we must be careful at the same time not to subordinate that policy to his limited and immediate interests. We have to arrange that he has an *expanding market ;* but he must not respond to that market by over-cropping and overstocking soils that are liable to degradation. He must, on the contrary, be assisted to improve his farming practices, so as to get the best out of his soil year by year. Since, however, our ultimate aim is a high level of consumption, we should, I think, return now to the study of men as consumers of food and consider in some detail the conditions under which they have been living.

Chapter Four

A LITTLE OF WHAT YOU FANCY

WHEN we come to consider our more remote goals we are faced with a very difficult problem. What *kinds* of food shall we ultimately plan to produce? No doubt we are for the moment limited in our choice by the conditions of soil and climate and by the ignorance of many farming communities. But in the long run people will have to be provided with the food they want. It does not, of course, matter very much whether a man prefers meat or fish, bread or rice. Yet the problem is a real one, because the Chinese has presumably as much right to decide on his own diet as has the Swede or the American. To have any other opinion would be to suggest that certain peoples are condemned to live permanently on a diet that would not be tolerated by the more favoured nations of the earth.

It will naturally take time. The farming economy of the United States is becoming progressively adapted to provide its population with a good mixed diet. But the League of Nations in its final report on world nutrition could only comment sadly that "in Asiatic countries any immediate increase in milk, eggs and butter is out of the question." We shall have to fall back on a series of short-term plans for countries where the level of farming or the density of population seems to make any intensive stock-raising for the time being impracticable. But what then? What of the more remote future? How, in fact, shall we convert the physiological standards we set ourselves into the foods that are to be produced and consumed?

I can frankly think of no principle except that of the tastes of the peoples concerned. We can dismiss as nonsense the idea that a Chinese coolie prefers to live on a few handfuls of rice. He does not. How his pattern of tastes might develop if he had the chance, we do not know. We can only attempt to find out, just as we would attempt to discover the tastes of a Welsh mine-worker or a Canadian engineer. In other words, what is in some respects a subjective or psycho-

logical standard of preference turns out to be the only objective standard to which we can possibly appeal. Our only guide is to discover what foods the people of various countries normally *tend* to consume whenever they have the chance.

There is a common idea that folk are very conservative about their food habits. To some extent this is true over a short period of time. But in a matter of two or three generations, a brief term in the life of a community, food habits and tastes can change in a remarkable way. Man is really quite adaptable in his diet. Take, for example, the increase in meat or sugar consumption in the western countries over the course of a century or so. Now, it may be rather unnecessary to suggest that people will eat more meat and sugar where they can afford them. Yet habits have changed in the west and will presumably change as easily in the east or on the continent of Africa. At the beginning of the 19th century most Europeans consumed very little meat ; and much of it was salted, smoked or dried. In a hundred years the average consumption of meat in several of the countries has increased three or even four times, so far as we can judge.

Consider again the figures that show the rise in sugar consumption. In 1821 the inhabitants of the United States were eating on an average under 8 lbs. of sugar a year ; and this meant in effect that a large proportion of them consumed practically no sugar at all. By the year 1900 they were eating more than 66 lbs. of sugar a head ; and by 1928 the consumption of sugar in all forms had risen to over 100 lbs. In Britain it is estimated that the average consumption of sugar rose by five times in the century before 1930, while the average French consumption had increased in the same period by fifteen times.

But there are many foods that people have adopted into their normal diet, where the appeal to taste was far less obvious. Often, no doubt, the original motives that impelled them were economic. The new food crops had a better yield or superior keeping qualities. Yet an element of taste soon affected the preference for them. It is surprising how soon some of the new foods from America were adopted in the diets of Europe and Africa, once the people had overcome their natural conservatism. Until the close of the 18th century, for

example, there seems to have been little enthusiasm for the potato, except in such poorer areas as Italy, Ireland and our own northern counties. Elsewhere potatoes were used to some extent for stock-feeding, but they were either considered to be very low-grade food for humans or were dismissed on such arguments as that they had a narcotic quality or that they were a food not mentioned in Holy Writ. The wars and famines at the close of the 18th century, however, undoubtedly raised the popularity of the potato with its unusually high yield of food per acre ; and by the 'thirties of the last century it had become almost impossible to think of the meal tables of our western countries except in terms of the potato.

The spread of potato consumption in Europe has its parallel in the spread of maize cultivation in the continent of Africa. Maize appears to have reached Spain from America about the year 1500 ; and it was not long in spreading as far east as Turkey. In the century that followed it was being cultivated on the northern shores of Africa and had been carried by the Portuguese to their settlements on the western coasts. Whether it reached South Africa before the Dutch settled there about 1650 may be a matter of doubt ; but it was certainly carried by the natives as a crop deep into the interior soon after that date ; it is said to have found its way to Abyssinia by 1623 or even earlier. By whatever routes it travelled, it began everywhere to displace the original grain crops of the natives and to form the basis of their food economy.

Even where a food becomes cheap and readily available, the habit of consuming it may thus take a generation or more before it is established. Most foods that attract men for one reason or another have usually gained acceptance in proportion to their price. The consumption of meat seems to have increased with the growth of urban communities, whose incomes were somewhat higher and whose need for heavy supplies of energy food was somewhat lower than those of the peasant or the farm labourer. Yet even the mediæval peasant seems to have been sensible of the excessively large quantities of " red meat " that his overlord secured for himself ; and the class distinction of food was undoubtedly one of the more potent influences in recommending to the lower orders the taste for sugar, beef, butter and white bread.

There is evidence that the same class pressure upon the available sources of food supply is affecting every part of the world to-day. The taste of the well-to-do classes is naturally for a varied diet ; and it may be very similar from one country to another, even if the basic composition of the diet is affected in some measure by national tastes and by the food that happens to be available. The working class family, almost invariably tends to adapt its preference to the same types of food ; it can afford extremely little of the more attractive foods, but what it can secure it will eat and relish. Men have, in brief, a common preference for most of the animal products and for fruit and sugar ; they appear to differ only in their power to purchase a sufficiency of them.

Among white families in South Africa, for example, there was a fairly general tendency to consume milk and fat shortly before the war ; the only distinction was that the well-paid workers purchased about three times as much milk as the lowest, and more than twice as much fat. It is true that among the poorest families the consumption of milk was negligible ; but the habit must still have persisted. Where the income was three times as high, eight times as many eggs were consumed and double the butter. Only in the eating of bread did the poorer families outdo their more prosperous neighbours ; for they consumed at least 40 per cent. more.

In an Italian survey somewhat over a decade ago it was found that an urban worker's family had only about 60 per cent. the quantity of meat and fish enjoyed by an upper middle-class family ; it had, moreover, but 60 per cent. of the milk, 55 per cent. or so of the sugar and only 30 per cent. or so of the fresh fruits. Much the same range of tastes and purchases was characteristic of the workers of Mexico City in the 'thirties. The lowest income families consumed less than half the meat and fish consumed by the highest income families, much less than half the milk and only about 60 per cent. of the sugar. Studies of a similar nature have been made in several countries during the years that preceded the war ; and what we have to realize is that there was no abrupt distinction between class and class. The only apparent difference lay in the precise level of income that could be spent on food. In other words human beings seem by this time to have acquired an almost

universal taste for the varied foods with which we are familiar in the west.

It matters little, as far as we can discover, whether we appeal to the experience of America or of China. New England families with an income of 500 dollars were consuming in 1935 about $2\frac{1}{2}$ times as much fruit per head as those on an income of 300 dollars and less ; they were consuming $1\frac{1}{2}$ times as much meat and fish. But they all had a taste for meat, butter, sugar and fruit. The diet of a Peiping teacher may by contrast have been poor in meat ; yet he secured 6 times as much as did a Peiping coolie ; he further varied his diet with considerably larger quantities of sugar, vegetable oils and fruit, though his purchases were still relatively low and the fruit he bought was mainly melons.

More significant perhaps was a comparison made between the normal diets of farm labourers in China and those of some two to three hundred Chinese families in America, who were living under varied urban and rural conditions. It was not suggested that the migrants had sprung from the same peasant stock ; but whatever their origin, they had evidently been completely assimilated into the American pattern of life. They were deriving only some 32 per cent. of their daily energy from cereals, whereas the peasant families of China derived from that source more than 90 per cent. In other items of the diet the migrants had extreme advantage ; 39 per cent. of their daily energy came from animal products of some kind, as compared with only 2.3 per cent. in the case of the peasants. More than a tenth of the energy of the migrant families was obtained from the sugar in their diet ; the proportion of energy supplied to the peasant families from that source was negligible.

It seems, then, that the scientists were not far wrong in deciding to express the increase in the world's food supplies mainly in terms of milk, meat, fruit and vegetable oils. Any other solution to the problem would imply that, while some folk may have all the milk and meat they wish, their contemporaries will have to be permanently content with a diet that, if adequate on nutritional standards, falls far short of the standard set by normal human tastes. So far as we can judge, the lower classes everywhere tend to consume as varied a diet as do those with a higher purchasing power ; and it is, as we

have seen, only their poverty that limits the amounts they can afford. As soon as they have the opportunity, whether through higher wages or through migration, they vary their diets more completely by purchasing larger amounts of milk, meat and fruit. So universal is the rule, that it leaves us with no alternative solution.

Chapter Five

MAN'S DAILY BREAD

HOW far, then, have the diets of the world's populations failed to reach a reasonable standard ?

Let us agree at once that we shall have to leave the war years out of account ; the conditions have been entirely abnormal. We shall have to rely rather upon such figures as are available to us from the ten years before the outbreak of war. Now, the world that will have emerged from the war by 1950 will not be precisely the same as the world of 1939. But that makes little difference. Unless we take measures to prevent it, the world of 1950 will have begun to assume the same *kind* of pattern as it revealed before the war.

The most obvious method to adopt is that of finding out how far the various peoples of the earth could secure any but a basic diet of bread, rice and potatoes ; how far, that is to say, they have had to rely on cereals, supplemented with potatoes in some countries, for their main source of energy. That even the poorest communities have had at least this source of food supply is evident ; for they would otherwise have starved. The real question is, what they had to eat *beyond* so monotonous a fare. It does not, of course, follow that where we find a people relying for 80 per cent. of their diet upon rice, they are necessarily ill-nourished in any extreme degree ; that would depend on the composition of the remaining 20 per cent. But few of us would care to secure more than 60 per cent. of our daily energy from rice or bread alone. Even if we disregard our natural tastes all the evidence goes to show that a people, whose diet contains more than 60 per cent. of cereals or

potatoes, are nutritionally poorly provided. Their consumption of dairy produce, meat, fruit and vegetables is usually of a low order and often negligible.

To summarize the position, as far as we know it, I have inserted a simple table. The nations of the world are here divided into six groups according to the part played by cereals and potatoes in supplying their daily energy. Necessarily not all the inhabitants of the globe are included ; and in many instances the estimates have had to be made less from the results of direct surveys than from the statistics of production and trade. But the figures provide us with a broad order of comparison between nation and nation. Typical examples are recorded for each group, together with the total population falling within each group and the percentage relation of that population to the total population of the world in the last decade before the war.

TABLE 1

TABLE OF COUNTRIES, SHOWING THE PART PLAYED BY CEREALS AND POTATOES IN THEIR SUPPLIES OF HUMAN ENERGY.

Group	*Percentage of Cereal-Potato Calories in Total Calories*	*Typical Countries in Group*	*Population*	
			Number in Millions	*Percentage of Total*
1	30–39	New Zealand, Australia, Sweden, U.S.A., Canada, U.K., Switzerland.	205	11·1
2	40–49	Austria, Denmark, Norway, Finland, Germany, Netherlands.	93	5·1
3	50–59	Argentina, Hungary, Czecho-Slovakia, Belgium, France, Uruguay.	93	5·1
4	60–69	Mexico, Chile, Italy, Spain, Greece, Brazil, Peru.	169	9·2
5	70–79	Bulgaria, Poland, Japan, Tunis, Yugo-Slavia.	156	8·4
6	80–89	India, Java, Rumania, China, Indo-China.	1,125	61·1
		TOTAL ..	1,841	100·0

(The calorie is, of course, the unit of energy by which we measure both the work performed by the organism and the energy derived from various foods. It is, in this case, equivalent to the amount of heat required to raise one kilogram or 2.2 lbs. of water by one degree centigrade).

If this estimate be moderately correct, about a tenth of the world's population, concentrated mainly in the United States, Britain and her Dominions, has been relying for no more than 30 to 40 per cent. of its human energy upon cereals and potatoes. A further 25 per cent. or so of mankind, concentrated mainly in Central and South America and in the western and central areas of Europe has had to rely on cereals and potatoes for 40 to 70 per cent. of its available energy. Almost two-thirds of the world's population, on the other hand, derives 80 per cent. or more of its energy from cereals, mainly rice ; and this remnant spreads over the eastern area of Europe, over Asia and over a considerable portion of Africa. Provisionally we may accept the figures, though they do not, of course, allow for the varying standards of diet peculiar to the class levels in any one country ; and moreover they do not indicate the slowly changing standards of diet in a few of the countries, such as the U.S.S.R., which we have here left out of account.

There seems little doubt that the decisive factor has been the prices paid for the various foodstuffs. Men must eat ; and where their resources are small, they must needs eat the foods of highest yield and those that are cheapest on the market. A decade or so ago, for example, a citizen of the United States would frequently have had to pay eleven times as much for an inferior cut of beef as he would to obtain an equivalent amount of energy from a portion of wheat flour to bake into bread ; if he desired to secure the same amount of energy from milk, he would have to pay eight times as much and if from eggs fifteen times as much. A German in 1938 would have had to spend about a third as much again on sugar to get an energy value equivalent to that obtained from his rye bread ; he would have had to spend almost two-thirds as much again on lard. It naturally follows that depressed classes and communities are forced inexorably towards a diet of utter monotony ; and in sustaining themselves upon it, they are more or less malnourished.

But have we even produced enough wheat and rice in the world? I doubt it. You will remember that I quoted a writer as saying that there should be a 50 per cent. increase in cereals, and we agreed at the time that much of this would presumably be used for stock feeding. Several economists have pointed out that, as the western nations have grown prosperous enough to vary their diets, they consume less bread; and it is taken for granted that this process will continue. We grow, then, enough wheat perhaps for our purpose. Yet there are still peoples who live mainly on such grains as maize or millet but who would prefer wheat if they could obtain it. The area they inhabit probably covers much of the southern portion of the United States and Mexico, the Danube Basin and several of the coastal regions of the Mediterranean. In their case, however, it would merely mean that one cereal was displaced by another of a more nutritious and palatable kind. It is quite another matter when we come to examine the problem of the rice-consuming countries of the East.

Rice is said to be the staple diet of about half the human race. This may be an exaggeration, but it is safe to allow that rice is the main staple of at least 800,000,000 people, spread over Bengal, Madras, Ceylon, Malaya, the Asiatic Islands, Japan and the southern and central regions of China. All but some 5 per cent. of the world's rice was grown before the war in these areas of Monsoon Asia; and, though in the course of the war rice cultivation has been expanded in a few areas of the Western Hemisphere, the proportion cannot greatly have changed. Very little rice leaves its place of origin for the overseas market; perhaps 2 per cent. or so reached the European consumer before the war; and it would probably be excessive to say that a further 8 per cent. moved across national frontiers in Asia itself. Even this small redistribution of rice had, however, become of some significance. It meant that the surplus produce of such countries as Siam, Burma and Indo-China could be made to cushion the shock of temporary or permanent deficits in China or Bengal.

The complete failure of rice exports from Burma did not *cause* the Indian famines of 1943 and 1946. But the failure meant that there was no reserve of two million tons or so, that could have been called on in an emergency. In the earlier of the

two famines the deaths in Bengal amounted by official estimates to 1,500,000 : many would set the figure far higher. But the passage of war through Burma left the country by 1945 in a poor condition ; crops were low and draft animals had been destroyed. Indeed, the whole of south-eastern Asia was in no state to relieve the serious deficiencies in neighbouring countries. The only area that seemed to have some surplus rice was Siam ; and in Siam the effort of the military authorities to extract deliveries of rice by way of reparations meant that stocks were simply hidden on the farms or disappeared into the " black market." Not more than a few hundred thousand tons could be collected for relief.

This increasing dependence before the war on rice imports from the south east was not a wholesome symptom in Asiatic economy. Not only have the exporting countries been relying in normal times for 40 to 70 per cent. of their revenue from this traffic alone ; but they seem in the effort to maintain the revenue to have been decreasing their own levels of rice consumption. This is surely bad. What foods the inhabitants of Siam and Indo-China have been adopting in the place of rice, is not always clear ; presumably they have been consuming more maize and millet. Only rarely among them has the decline in rice consumption meant a recourse to a more varied diet of vegetables and animal products.

Moreover, the impression that they could always secure a few million tons of surplus rice from beyond their frontiers has probably tended to delay the necessary process of agrarian reform in the heavily populated countryside of India and China. Most of the rice in these regions is produced by the villagers for direct human consumption. Not more than 3 per cent. or at most 5 per cent. of it is fed to stock. Some is of course sold to the towns ; the larger proportion is consumed where it is grown. Indeed, the average Chinese farmer would not usually purchase more than a quarter of what he eats ; and that quarter is mainly composed of vegetable oils and animal products for his feast days and holidays. In lean years the amount purchased is trifling. To what extent, however, is it true to say that the Chinese, while his diet may be unvaried has at least in normal years a sufficiency of rice ? I doubt very much whether he has. It has been found, for example, that as the

RICE AREA
of
MONSOON ASIA
MANCHUKUO
CHOSEN
Tokio
JAPAN
Shanghai
CHINA
TAIWAN
Pacific
Ocean
Hong Kong
INDIA
Calcutta
BURMA
FRENCH INDO-CHINA
Bombay
Rangoon
THAILAND
Manila
PHILIPPINE
ISLANDS
Madras
Saigon
CEYLON
BRITISH MALAYA
Singapore
Indian Ocean
SUMATRA
BORNEO
NEW GUINEA
JAVA
Equator
PSG

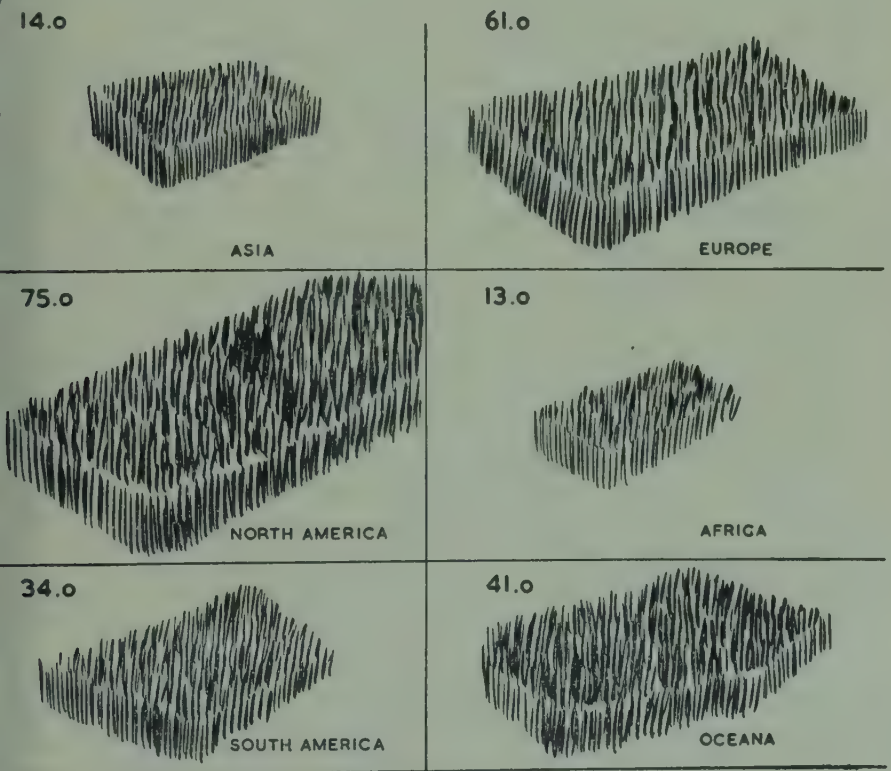
income of the average Peiping family rises, so for a while does its daily consumption of rice. Before its desire for rice has been fully satisfied it may be almost doubling its original level of consumption. This certainly suggests that a large proportion of the poorer families were not only lacking meat and fats, they were in the precise sense of the term *underfed*. But we must realize that for the southern Chinese meals are almost invariably based upon rice ; rice is not merely eaten as an accompaniment of the main dish as is bread in European countries. The Chinese enriches his rice bowl where he can with additions of meat, fish and vegetables ; and the extent to which he does so is the measure of his relative prosperity.

All the evidence seems to show that the condition of the rice-eaters of India has been somewhat worse in normal years than that of the Chinese. The average poor peasant of Southern India has been estimated to secure from his diet a daily supply of energy that is probably 10 per cent. below what we might have expected in a man of his build and type of work. That may be taken as a measure of his deficiency in the *quantity* of food he consumes. At all events, in 1933 the Director-General of the Indian Medical Service stated that in all India some 40 per cent. of the villages had a population that was excessive in relation to their food supply ; the percentage rose to 46 in Bengal and the Punjab, and to 60 in Behar and Orissa. Perhaps after all there is some truth in the bitter comment that India has been for many years the country where there are always " three mouths for every two bowls of rice."

Over the last twenty years the rate of increase in Indian rice production has tended to slacken ; the population of the country has in the meantime risen steadily. Between the closing years of the 19th century and the end of the first world war both the acreage and the production of rice showed a large increase ; but from that period to the outbreak of war in 1939 the acreage has expanded very slowly and the yields per acre were at the best stationary. This was obviously insufficient for the needs of a population that has grown by at least 40 per cent. since the turn of the century. To have recourse to importations of rice from Burma and elsewhere was, as we have seen, a dangerous expedient. In 1939 the imported rice accounted for more than half the total food imported into the country ;

APPROXIMATE PERCENTAGE OF GRAIN USED IN DIFFERENT CONTINENTS FOR FEEDING LIVE-STOCK AND FOR SEED PURPOSES

CONTINENT	ASIA	EUROPE	NORTH AMERICA	AFRICA	SOUTH AMERICA	OCEANIA
PERCENTAGE USED FOR FEED & SEED	14	61	75	13	34	41



this was, of course, not a large proportion of all the rice consumed, but it was a symptom that should be treated seriously.

The only alternative in Asia is to apply new methods to rice production in an effort to raise the average yield of rice per acre. No very rapid expansion of acreage seems practicable. It has been estimated that in China, for example, by a more economical use of the land, the cultivated area could possibly be increased by a tenth or little more. A far larger increase in the total rice crop would be realized through improvements in farming technique. Yet, while research has been in progress both on the choice of seeds and on the use of suitable fertilizers, practice has tended to lag far behind theory. It has been stated that by 1939 no more than 5 per cent. of the total rice area of India was under improved varieties of rice. No small part of the problem of the whole continent lies in the tradition of land tenure and in the excess of labour on the land. We are once again compelled to recognize that in these peasant countries we can only improve the diet of the people by making some attempt to modernize the farming system. Yet merely to increase the size of holdings and to introduce machine methods of farming would mean the creation of a vast horde of unemployed and landless labourers.

As matters now stand, the average annual output of a Chinese farmer is extremely low by western standards ; his output was before the war little more than a fourteenth part of that of his average American contemporary. Until practical experiments have been carried out on a large scale, it will be impossible to know precisely how far intensive agriculture gives us some prospect of obtaining the crops we need. We have only the estimates of a few scientists on which to rely ; and these are usually, it must be admitted, very encouraging. One survey carried out in Siam rather more than a decade ago suggests that yields in that country could be generally doubled and that even the area under rice could be increased by 30 per cent. It would take time, possibly as much as forty years, to revolutionize Siamese farming ; but it was in the opinion of the writer quite a practicable undertaking. In India, one gathers, the yield of rice might be increased by at least 30 per cent. ; and in that case most of the increase would arise from a better system of manuring the soil.

But the growing populations of the monsoon area are still pressing heavily upon the available supplies of rice and other grain ; and the consumption of live-stock products among them is necessarily low. Farm animals are used for draft purposes to an extent that would be almost inconceivable in the western countries. Not only can the peasant afford to divert little of his yield to stock feeding ; his pasture lands are at present restricted and often poor in quality. In China, for example, pasturage now constitutes scarcely more than 1 per cent. of the total farm area, whereas in the United States between 40 and 50 per cent. of the farm area is given over to stock-raising. Of the large farm stock owned by the Chinese, including mules and horses, only about 25 per cent. are kept for their yield of milk and meat ; in Germany some 85 per cent. of large stock have normally been kept for food purposes and in Britain at least 90 per cent. It is, in other words, a predominately vegetarian diet that we have to consider, when we survey the Asiatic half of the world's population.

The swarming multitudes have to extract all they can with their meagre resources from such soil as seems available to them ; and there is, or appears to them to be, little land remaining for the feeding of dairy herds, pigs and poultry. There is no prospect of an immediate change. Before the oriental diet can be varied we have to be sure that there is a sufficiency of the staple foods ; and in the meantime cereals will compose, as we have seen, at least 80 per cent. of the diet.

Turn once more to the table and consider what it implies. It is closely packed with figures, as indeed has been the whole of this chapter. Yet you can easily think of the meaning of these figures in the terms of men with their farm crops, their animals and their firesides. Far too many of them live even in the best of times upon a diet that is not only poor in quality but what I should call uncivilized. Where their grain crops fail them they are faced with the prospect of starvation ; for they have no other food upon which they can rely. When we speak of famine, we *mean* the failure of the grain crop. But the misery of famine is only the last form of wretched existence. We can certainly produce enough wheat and rice in the world to save us from the fear of famines. What then ? By all means let us grow the rice and wheat ; yet when we have grown them we

are still confronted with the millions who find at their meal tables little good nourishment and even less savour or sweetness.

Chapter Six

THE SWEETS OF LIFE

I SUPPOSE most people prefer to have a little sugar at their meal tables. A moderate consumption of sugar is a mark of civilized life, though the refined sugar we eat gives us little more than a modicum of energy. As a matter of fact, a civilized community will usually mix a considerable quantity of its flour with sugar and fat to provide itself with pastries and cakes. In this country we seem normally to have been consuming much of our flour in this form ; and even in time of war we were still using at least 25 per cent. of the flour for the making of biscuits, pies and confectionery. If this is really our standard of a civilized diet, we should have to regard the diet of an average Pole or Hungarian as distinctly primitive. During the 'thirties they had less than a quarter the amount of sugar that we were consuming in our various ways ; and I need scarcely say that most of the peasant families of these countries had far less than that. There are always some people who have more than the average and many who have less.

I do not find it easy to estimate how far the world was short of sugar. I am not sure, for one thing, how much sugar people want to eat. According to one American writer about a decade ago, the world was then producing some 70 per cent. of the sugar it required ; but the writer seemed to take little or no account of the possible demand for sugar that might exist in the oriental countries. Let us adopt as our standard a fairly modest level of sugar consumption. Before the war the member of an average Dutch family seems to have been eating in various ways rather less than a pound of sugar a week. That does not appear very excessive. If we apply this standard to all countries in the world, we come to the conclusion that we should have to double the production of sugar, in order to raise every human being to the same level of decency. We

must remember, when we speak of a pound of sugar a week, that we have even in war been eating far more than the 8 oz. we have in our rations ; allowing for all the other forms in which we consume sugar, we have probably been getting between a pound and a pound and a half a week.

It would be by no means beyond our power to increase the production of sugar to this extent. Sugar production in the world has probably increased by at least 50 per cent. over the last half century, though the output has been subject to some fluctuations from period to period.

We owe it, of course, to our very considerable imports of sugar, that we have been able for many years to maintain our own high level of sugar consumption. Most of the countries of Europe, on the other hand, have been trying to support themselves from their home production of sugar beet. This was not altogether a wise policy, even if it was suggested to them by their fear of being dependent upon imported sugar. It meant that the producers of sugar from the sugar cane plantations found that their overseas markets were steadily declining and that they sought refuge in restricting their output. Moreover, many families in Europe were thus deprived of cheap supplies of sugar. The level of consumption has varied from country to country. An average Spaniard in the early 'thirties was eating little more than 25 per cent. of the sugar eaten by an average American, an average Yugoslav less than 15 per cent. This was partly due, of course, to the low output of sugar in these countries and to the excessive price of sugar in the market ; but it was due in part to the very uneven way in which the sugar from overseas was being distributed among the various countries of the world.

Cane sugar is produced for export in a few regions of the earth, which are suitable for the cultivation of the sugar cane. These regions are mainly about the islands of the Caribbean, the Pacific and the Malay Archipelago, in South Africa and in Australia. In the late 'thirties the annual export of sugar from these countries had reached a level of about eight million tons. But the tides of sugar were deing distributed among the world's markets in currents of most uneven volume. More than half of the eight million tons flowed to the United States and about a quarter found its way to our own ports ; a large

proportion of the residue went to Japan, Canada, and a few of the countries of Latin America and western Europe. Indeed, the United States, Britain and Japan between them must have been absorbing more than 90 per cent. of the exportable produce of the sugar cane plantations. This certainly seems a classical example of what the American economists call the *imperialization* of the food markets. Some of the countries, that were trying to make themselves independent in sugar production, could undoubtedly have imported more sugar from overseas, if they had wished to do so. But the fact remains that several of the more heavily populated countries were prevented from doing so by poverty alone ; they simply could not compete for the available sugar.

Let us return to our estimate that we might have to double the world's production of sugar, if everyone is to have a reasonable share. The fact that before the war the exportable sugar was concentrated into a few favoured countries is not a matter of great moment, provided we can raise the level of production sufficiently to even out the flow and so meet the demand. But, as I have said, if there was still before the war a considerable demand in several of the European countries, it was trivial by comparison with the needs of the oriental countries.

Even the professional classes among the Chinese seem to have had little opportunity of sweetening their dishes ; for it is doubtful whether they purchased on an average before the war more than an ounce of sugar a week. The quantity purchased by a Chinese labourer or peasant was scarcely worth considering. In many parts of India the level of sugar consumption was perhaps somewhat higher. Sugar production in that country has been expanding over the last twenty years ; but distribution is not likely to be so even as to give every family its fair share of the produce.

Sugar is only a civilized way of making flour and fruit more attractive to the taste ; and it is a convenient source of energy. Milk, on the other hand, is the natural food of all new-born mammals. It is, we may say, an almost perfect food ; and every writer on the subject seems to agree that an ample provision of milk is at least desirable for all children and nursing mothers.

It is believed that about half the total milk yield in the world is consumed as fluid milk. But that can scarcely be more than a scientific guess ; and the proportion certainly varies very much from area to area. In a hot country such as India a considerable quantity of the scanty supplies of milk is probably made into butter and products of a similar nature ; the average consumption is in any case negligible, as it is over the greater part of Asia and Africa. Let us, however, concentrate mainly upon the consumption of milk in its fluid form ; and let us attempt to trace from a few selected instances the milk pattern of the world's peoples, as it was unfolding itself before the war.

During the 'thirties various surveys were made of the diets of Chile, the country that runs for more than 2,500 miles along the Pacific coast of South America. The consumption of milk was consistently low, though it varied as usual from class to class. On an average the consumption of milk in liquid form was less than a pint a week ; and it was said that, if all the milk in the country were kept for children from one to nine years of age, there would still be too little milk produced. The writers assumed that no butter or cheese was made and that all infants were breast-fed. There is little need to contrast so low a level of consumption with the standard of more favoured countries ; but some comparison is necessary, if the true state of deficiency is to become clear to us. If we take all the milk and milk products consumed by an average inhabitant of Chile and reduce them to quantities of liquid milk, we find that the amount consumed was at that period less than an eighth of what it was in the United States and less than a ninth of what it was in Denmark. Conditions have certainly improved somewhat in recent years, as they have elsewhere in Latin America ; but the figures are sufficient to show the great disparity that may exist between one civilized country and another.

There are countries in Europe where the level of milk consumption has been almost as low ; and in Europe, too, there is a marked disparity between one country and another. The average Pole of the mid-'thirties obtained little more than 30 per cent. of the milk and milk products consumed by the average Swede, the average Italian little more than 16 per cent.

There has been, nevertheless, a considerable increase in the habit of milk-drinking in most of the European countries since the early years of the century ; and the trend has been particularly marked in the western countries. It is one of the more hopeful signs in the changing pattern of food habits among the civilized nations ; and we may presume that the trend towards a higher milk consumption will re-establish itself, once the disastrous fall in the number of dairy cows has been checked and reversed.

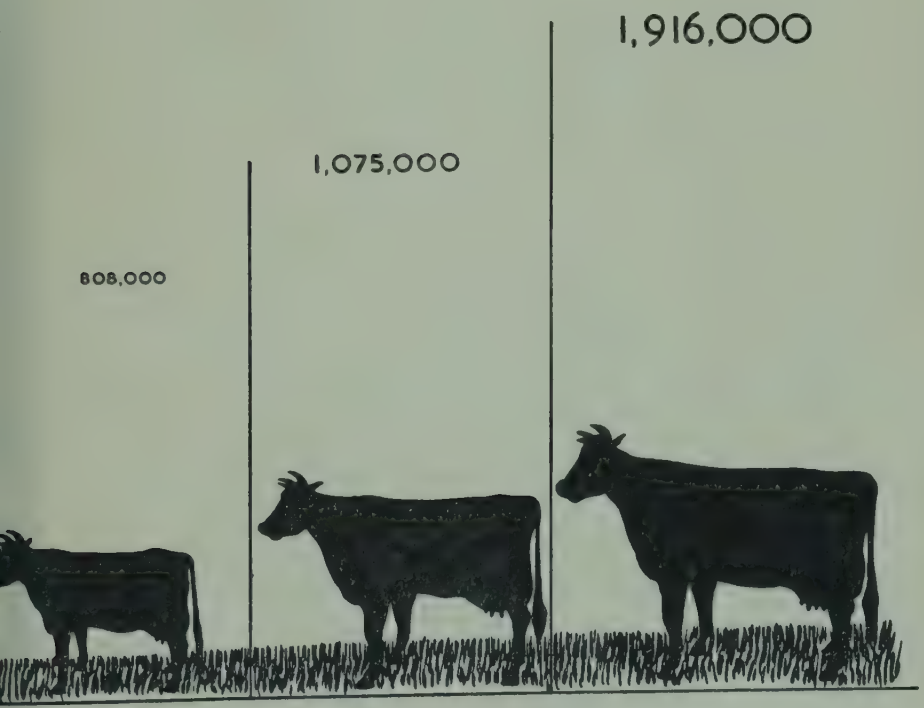
It is quite another matter, when we come to the problem of the great land masses to the east and south of us. In our own African colonies, for example, the amount of milk consumed is usually so low as to be negligible. The cattle are for the most part too few in numbers and of too poor a quality to ensure the supplies of milk that would be needed. Such milk as can be provided is constantly in danger of contamination. The only marked exceptions to the general rule appear to be a few tribes dwelling in East Africa, who indulge in a pastoral diet of meat and milk ; and among some of the Somalis there is a fairly high consumption of camel's milk. But any increase in milk production for the continent as a whole will obviously take many years to effect ; and in the meantime it is extremely difficult to ensure the purity of the product. The most practicable method so far suggested is that of establishing processing plants for the conversion of the fluid milk into a dried or condensed product ; the dried milk could then be used, together with any imported supplies that are available, for the feeding of children in schools and other institutions.

Dried skimmed milk has, we may note, been imported into India in recent years ; and it has been recommended by the health authorities for the supplementary feeding of school-children. The quantity imported does not seem to have been large ; it reached about 10,000 tons by the mid-'thirties and this would only provide a few million pints of milk. But a certain number of children in the larger cities have benefited from the measure ; and we may believe that it marks a precedent that will be gradually followed in various parts of the Commonwealth.

The level of Indian milk consumption is very low. One

RISE IN THE Nº OF COWS IN DENMARK

YEAR	1870	1900	1934
No. OF COWS	808,000	1,075,000	1,916,000



estimate gives the average consumption of fluid milk as less than a pint a fortnight ; but in a country of this kind an average estimate means very little. There are areas in the north, where the consumption both of milk and of milk products is considerably higher. The diet of the poorer rice-eaters of the south, however, is similar in composition throughout the area they inhabit. They consume milk in negligible amounts or not at all. The consumption among Bombay labourers is said to amount on an average to about a pint a month.

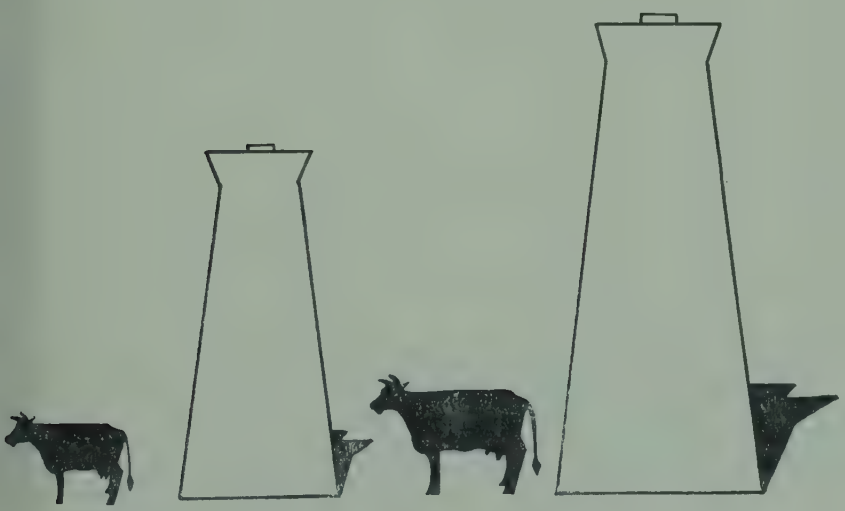
In India, of course, the real problem is that of finding suitable grazing grounds for the cattle and then of improving them systematically. While fodder for the cattle is still poor, any effort to improve the quality of the dairy stock, as for example by the use of selected bulls, would be more or less a waste of time. Fodder crops are grown in a few of the provinces ; but except in the Punjab they cover a very small proportion of the cultivated acreage. As a result of the low state of fertility in most of the grazing areas the quality of the milk is poor and the yields are very low by western standards of production. Indeed, the average yield of a village cow in the whole of India is said to be no higher than 60 gallons a year ; and that is less than 15 per cent. of the average yield of dairy cows in our own country.

When we move eastward into China, the consumption of milk practically ceases. In the mid 'thirties it was found to be insignificant, even among middle-class families. There was naturally some tendency among the well-to-do of the large cities to adopt the habit of milk-drinking ; such a tendency is usually to be observed, wherever the customs of the west have begun to take root. In Shanghai, for instance, a few licensed dairies were opened, retailing by the late 'thirties some 3,300 gallons daily ; but how far would 3,300 gallons go among the teeming multitudes of Shanghai ? The only recourse the peasant woman can adopt is to keep her child at the breast as long as possible ; and most children after they are weaned never taste milk again.

We may naturally ask how a country like China could possibly develop a dairy industry of such a size as to provide it with the milk it needs. The answer apparently is that

TOTAL PRODUCTION OF MILK IN 7 WESTERN EUROPEAN COUNTRIES IN THOUSAND MILLION PINTS

AVERAGE 1925 TO 1929	1933 TO 1934
6.73	7.95



dairying would be practicable enough in several of the southern areas of the country, though it could only be established over a term of years. It was not until farm economists from this country and from the United States began to survey intensively the soils and the climatic conditions of China, that they realized the extent of the sloping grass lands that cover a large part of the country south of the Yang-tse. These grass lands account for a total area even larger than that of the cultivated valleys ; and though they have been occasionally used as rough grazing, they have only recently been examined to see how far it might be feasible to convert them into good pastures and stock them with selected breeds of dairy cows. The plan is by all accounts as practicable as a number of other plans of agrarian reorganization. The condition of several of the areas has some climatic resemblance to that of the grazing lands of New Zealand ; and they might well, after a process of manuring and cultivation, become the basis of a flourishing dairy industry. No doubt a large proportion of the milk would have to be dried for transport to the more remote markets ; and we should no doubt have to make a start with a few model co-operative undertakings. But in these grass lands of southern China we have at least some evidence of the extent to which we are still neglecting our natural resources in the world. The secret of milk the world over is grass ; and grass is a crop that needs as careful scientific management as does any other crop we grow for our sustenance.

Chapter Seven

MEAT

A LOW milk supply in any country usually means that the children are poorly nourished. But we need not assume that the country is ill-provided with animal foods. The Japanese, for example, drank little milk ; but they consumed, as we have seen, a considerable quantity of fish ; and they so arranged matters that they were at least better fed than most

of their neighbours. The inhabitants of Chile may have been poorly provided with milk, but they must definitely be classed among the meat-consuming peoples of the earth. They were, in the mid 'thirties, eating weekly some 2 lbs. of meat a head, and that was as much as the average Swede or German obtained. Chile, however, is not one of the large stock-raising and meat exporting countries of the world ; and its average consumption was less than half the consumption that has commonly prevailed in Australia or in the Argentine.

For the last fifty or sixty years several hundred thousand tons of meat have been annually exported overseas from the great producing areas of the southern hemisphere. As compared with the total amount of meat consumed in the world the quantities are not, of course, very large ; most of the world's meat is still eaten in the country of its origin. But the one or two million tons of exportable meat have made a considerable difference to such countries as our own. Thus, to put it simply, the countries with a high consumption of meat have been in the main the great overseas producers of meat and dairy products and the countries that could, as in the case of Britain, draw food in the form of tribute from their economic dependencies and spheres of investment.

The world has, for the last century, been gradually assuming a food pattern that is unmistakable. While regions of the southern hemisphere became specialized for the export of beef and mutton, they did not disperse the few hundred thousand tons of exported meat equally about the globe. On the contrary, their market was a very concentrated one. In the years 1934-38 no less than 80 per cent. of all the beef and mutton shipped from the producing areas has been consigned to British ports ; and most of the balance reached the countries of western Europe.

There was a close parallel to this in the way in which our own country had become almost the sole market for exportable bacon and pork. A great proportion of the exported bacon and pork was produced in Europe, mainly in Denmark and the Netherlands, though somewhat under a quarter of the total supplies crossed the Atlantic. But whatever their source, it seems clear that at least 90 per cent. of these products went ultimately into British consumption.

As I have said, we should not assume that the countries that relied upon the British market suffered in thus sending us their food stuffs. On the contrary most of the beef and bacon exporting countries were among the best fed in the world. Like other countries they have their depressed and malnourished communities ; but it has been estimated that, of all the food exporting countries, they were almost alone in retaining within their own frontiers as much food of varied kinds as they needed for the well-being of their populations. With some of the smaller food exporting countries, however, the position is very different. They have tended to export food at the expense of their own people ; and this would be true of many of the countries of eastern Europe and of the northern seaboard of Africa. While they exported certain quantities of mutton or pork, their own level of subsistence was almost invariably wretched.

But, even if the overseas producers have not in many instances suffered by the export of their food-stuffs, we can scarcely believe that this peculiar concentration upon the British market is wholesome either for the British or for the overseas economies. The concentration upon the British market is due to the complete lack of any effective demand in most of the southern and eastern countries of Europe ; and an ineffective demand is, after all, merely a need that is not backed by the power to purchase the food required. The average Pole or Italian seems to have shown no strong dislike for meat in his diet ; but his poverty has made his consumption of meat considerably less than a third of what it commonly is in our own country.

We can now see that Britain has been assuming a very curious position in the world markets. We have relied to a disproportionate extent upon imported foods ; and our real problem is whether the producing countries will be content with this market alone. Will they not inevitably tend to seek for new markets, whatever be the immediate difficulties in finding them ? No one wants to sell *all* his mutton or bacon in one market, if he can possibly help it ; and if other countries have a chance of purchasing supplies of imported meat, they will assuredly begin to compete for the one or two million tons of exportable surplus that the world can provide.

We have no means of judging at present how far a taste for meat might gradually affect such of the Asiatic peoples as have no prejudice against it on religious grounds. If they acquired the taste and could afford to satisfy it, they would presumably in time be competing for Australian beef and New Zealand mutton ; and, were there any perceptible rise in demand from these quarters, fresh stock-raising areas would certainly have to be developed. There should be no great difficulty, I believe, about the opening of new pasture lands, provided we take measures to preserve the soil of any likely areas from degradation. Indeed, the scientific development of the dry territories in such a country as South Africa would probably save them from falling into a state of utter desolation. Many of them are at present overcropped, poor in sustenance and subject to extensive erosion. But 80 per cent. of the total land surface of the country is fit only for pasturage ; and if the available grain areas were used rather for fodder-growing than for wheat, a prosperous live-stock industry might well be fostered.

We have, however, to realize that good veldt management would be required ; and this to some extent depends upon our ability to raise the living standards and the educational levels of the native population. South Africa is, after all, a country of contradictions. It seems to gather within its frontiers most of the problems that now afflict the world. For example, it exports in normal years dairy produce, fruit and even a proportion of its meat. Yet it does so demonstrably, as do so many other countries, at the expense of its own inhabitants. South Africa, let us recognize, has a population of about 10,500,000, of whom no more than 2,200,000 are of European origin. The diet of a large percentage of the natives appears to be poor in quality, though at least 75 per cent. of them live in rural surroundings. Among the whites there exists a depressed and mainly urban class, fairly high consumers of meat but consuming small amounts of milk and milk products. The fact that, in spite of the low dietetic level of so much of her population, the country normally shows an export balance of butter, cheese, dried fruit and even meat, has struck many observers. During the course of the war, home consumption of these foods has risen considerably and would, it is said, have

TECHNOLOGICAL RESEARCH

risen still higher, had the supplies been available. Only in citrus and other fresh fruits does there seem to have been a surplus over the effective demand of the people ; and this surplus was mainly disposed of through schools and institutions. The rising level of domestic consumption is a measure of the unsatisfied need of the country before the war. The pre-war practice of exporting butter and fruit, usually into the British market, left the average domestic consumer on a relatively low nutritional level.

Yet a policy of sound veldt management would probably convert South Africa into one of the great meat and milk producing countries of the world. She might have to import a fair proportion of her wheat and maize ; but that could be contemplated without making too drastic a change in her economy. In the first stages, however, the native would have to be gradually transformed into a stock-breeder dependent upon a money basis of value, rearing his stock for the market and submissive to the elementary laws of good grass farming.

There are many other areas, that could be used to increase the world surplus of exportable meat ; but the process will necessarily be slow. A shift in the effective demand for meat, whether fresh or canned, to countries that have hitherto subsisted on a low meat diet, would inevitably mean that the relatively small quantities that are at present available must be spread over a wider area of consumption ; and in that case countries like our own, that have been relying upon a high standard of imports, must for a time be content with little above the rationed level. A rising demand in other countries, however, depends upon what opportunity they have of entering the world market with their own produce or of adjusting their farming pattern so as to yield more bacon and beef for home consumption.

Chapter Eight

THE FAT OF THE LAND

MOST of us tend, where we have the means, to increase our daily consumption of such fats as butter, margarine and oil. Those in a position to do so might normally, indeed, derive 20 to 30 per cent. of their intake of human energy from this source alone, at all events in the more temperate climates of the world. The reason is obvious. Not only do the fat foods give variety and often an added dietetic value to the fare, but weight for weight they yield far larger stores of human energy than do rice, bread or lean meat.

So varied are the sources of fats and oils, that it would take some time to trace their distribution among the nations of the globe. But we know, of course, that, since the last decades of the 19th century, the countries of Europe and North America, finding their own production of butter and other animal fats insufficient for their needs, have reached out to acquire from elsewhere increasing reservoirs of edible oil. These reservoirs were primarily those of vegetable oils, derived from oil-bearing plants, which are mainly cultivated in the eastern and southern areas of Asia, in North and East Africa and in parts of the seaboard of South America. We have also in more recent years derived part of our supplies of edible oil from the whale fisheries of the Antarctic. It is true that by no means all these products are used for the manufacture of human food. Much of the extracted oil is still employed for industrial purposes. In recent years, however, the proportion diverted for such industrial purposes as the manufacture of soap has tended to fall somewhat. In the last decade before the war about 70 per cent. of the total fats and oils was consumed directly as food. By 1929, indeed, the output of margarine in Europe was beginning to rival the butter output ; and if the consumption of fluid milk rises in the world, it will doubtless in time surpass it.

These tides of edible oil, released by the fat-hunger of a

few relatively prosperous countries, have naturally flowed in uneven currents about the earth's surface. The average annual export of vegetable oils in the years 1934-36 from the tropical countries of their origin seems to have reached about 3,240,000 tons. Of this quantity some 760,000 tons came from the African areas of cultivation and about 1,910,000 tons from Asia. More than 3,000,000 tons or over 90 per cent. was distributed among the countries of western Europe (including Germany), North America and Japan. Meanwhile, the average annual production of whale oil in the Antarctic during the years 1935-37 was 515,000 tons ; and of this some 80 per cent. was ultimately shipped to the United States, Britain, Germany and a group of the smaller western European and Scandinavian countries.

These figures give no indication of the quantities of butter and lard products consumed in these more civilized countries ; but they are frequently large, certainly far larger than the quantities consumed in most of the oil-producing areas. It would be difficult to compute what precisely is implied for the peoples of the African and Asiatic continents by this steady drain upon their resources of vegetable oil. Between them (excluding the U.S.S.R.) they probably produce considerably more than half the world's annual supplies of vegetable oils of all kinds, if these be reduced to a common basis of calculation. Out of this they appear normally to have exported almost a half ; and their imports in terms of butter and processed oils are insignificant, while their internal trade in their own products is not of a high order. Thus this fraction of the human race, about 60 per cent. of the world's population, has at best little more than 25 per cent. of the world's edible oils on which to indulge itself. In the areas of production some of the palm oil and coconut oil may be used in cooking, and in several parts of India the use of oil for culinary purposes seems to be relatively common. Among some of the textile workers of Madras, for example, consumption of oil in cooking is said to reach on the average a pound or so a week. But for the most part consumption in the tropical countries is still of a low order and will not be increased perceptibly until a higher proportion of the oil-seed plants is processed and retained within the countries of origin.

There is a further aspect of this drain of edible oils and oil-seed products from the tropics, that should be recognized. The residue after the extraction of the oil is usually processed into a concentrated cake by the importing countries for feeding to their farm animals. Such cake is rich in various substances ; and a great part of the nutrient value naturally passes on to the soil in the form of manure. The soil of such countries as Britain and Denmark have thus been gaining useful additions annually of nitrogen, phosphate and other plant nutrients ; and corresponding quantities of them have been removed from the soils of tropical countries, in which the oil bearing vegetation was grown. The annual drain may not be very large, but it is not insignificant and it is accumulative. During the 'thirties about 10 per cent. of the extra phosphate added yearly to our own soil, both from inorganic fertilizers and from the manure derived through imported feedingstuffs, came from the residue of oil-bearing plants. The proportion of extra nitrogen added to the soil in this way was considerably higher ; it amounted to about 30 per cent.

We have thus been tending to maintain the yield of our dairy cows and the fertility of our soil partly at the expense of the tropical soils, to which the plant nutrients should properly have been returned. The process is slow, but it must in time begin to tell on the soils, from which the plant nutrients are being drained away. " It seems unlikely," observes one scientific writer, " that the poor soils of India, Africa and South America can be indefinitely *mined* to enrich our soils. These countries will need to process their farm products, so as to retain protein and other nutrients for their own people, stock and land and to export mainly oils, fibres and starchy foods, which carry away only elements derived from the atmosphere." In other words, the oil-bearing plants may have to be processed on the spot for the production of margarine and other fats, leaving the residue with its content of nitrogen and phosphate to be returned to the native soils as manure. Even then the cultivation of oil-bearing plants would have to be considerably expanded, if the inhabitants of these countries are to receive somewhere near their fair share of the world's total production of fats and oils.

All that we have said raises some very serious problems.

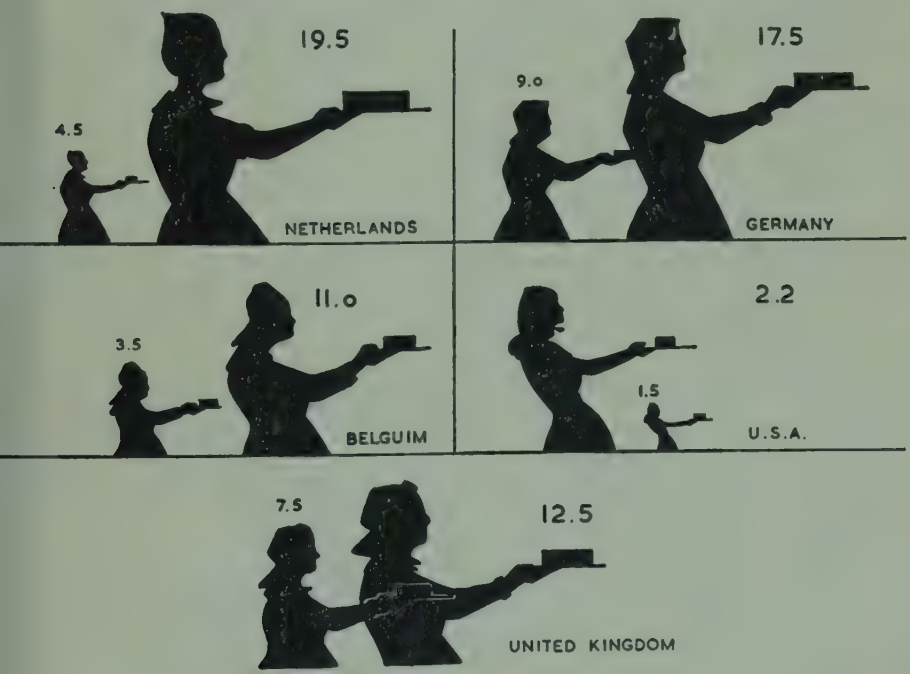
Let us consider this world trade in food. If we exclude the United States, all the countries that export meat, butter and fruit have relatively small populations ; several of them have in the main a respectable level of consumption of the foodstuffs in which they deal, though there are, as we have seen, certain exceptions. Only the countries that produce and export vegetable oils seem to lie significantly outside the general rule. But if most of the countries that export high quality foods, such as meat and butter, are still sparsely populated, the main importing countries also account between them for a very low percentage of the world's population. Omitting the United States, which has only been entering the world market to any extent for sugar, vegetable oils and some fruits, we find that a large proportion of the overseas trade in food stuffs is diverted to about 7 per cent. of the world's consuming public. Thus it appears, in fact, that some 10 to 15 per cent. of the world's inhabitants are engaged in distributing among themselves the large bulk of the annual export production of meat, sugar, fruit and dairy foods. The *total* amount of food thus entering the world market is not, of course, very large, though for the few countries to which the food is consigned it is of great importance. These favoured countries have been exerting a magnetic kind of influence upon the food markets, not because there has been a superabundance of the various foods, but because there has been no effective competition.

What, then is the real situation ? Most communities in the world are awakening to the idea that they would prefer a good mixed diet with a variety of animal and vegetable products ; and since this idea seems to agree with the scientific notion of a sound diet, who am I to resist it ? Tastes will doubtless differ for many generations to come, so far as affects the choice between bread and rice or between fish and meat ; men express in this manner their distinctive cultures and traditions. But the *balance* of the diet they are seeking has the same broad characteristics.

A large proportion of mankind has obviously not attained to such a standard. Most of them are still wretchedly poor and live in countries with a poor tradition of farming and a scale of food imports that is far too low to allow much variety on the meal table of the masses. There are very few countries,

GROWTH OF MARGARINE CONSUMPTION IN VARIOUS COUNTRIES IN POUNDS PER YEAR PER HEAD

COUNTRY	NETHERLANDS	GERMANY	BELGIUM	U.S.A.	UNITED KINGDOM
1913	4.5	9.0	3.5	1.5	7.5
1930	19.5	17.5	11.0	2.2	12.5



where schemes of agrarian reform could not in the end vastly increase productivity. On the further plane there are countries, whose farming output of wheat or sugar is limited only by the failure of overseas markets to absorb the produce ; and all we need here is to make effective the demand for wheat and sugar that we have seen to exist, for example, in most of the southern and eastern countries of Europe. Meanwhile, several of the countries have been shipping exportable reserves of food, mainly to a few limited markets. On the whole, these shifting surpluses do not amount to a large proportion of the food annually consumed in the world ; if we exclude the traffic in wheat and other grains, they would only reach a few million tons. But what does this trade in food mean ?

We have to recognize the existing structure of the world trade in food products, since it influences the whole pattern of consumption. The exportable surplus of food, as I say, is by no means inexhaustible ; and it could theoretically flow in many directions. Where a country becomes slowly prosperous and begins to industrialize, it will normally retain within its borders a fair proportion of the food it had been in the habit of exporting ; it may even reverse the process and begin to enter the market for overseas food. Where a country opens its ports to fresh immigrants, or where it initiates schemes for diverting milk and other foods to the subsidized feeding of its children, it must again obviously use some of the food it had been in the custom of exporting. Naturally its government may also take measures to raise the level of production and in the long run, have even more food to offer to the overseas market than it had in the past. But it all depends on the rate at which the various processes of change and reform develop ; and one can only say that the still restricted volume of meat, dairy produce, vegetable oils and feeding stuffs will not necessarily continue to follow the same lines of distribution as they had been tending to assume before the war. We have experience of the working of this principle in our war-time milk policy. When the limited supplies of milk are more evenly distributed through various welfare schemes, certain classes find their consumption of milk inconveniently restricted ; the only remedy is to raise the total level of milk production and that takes time.

As the resources of science are applied to the conservation and improvement of the soil and to the selection of the best seeds and stock, productivity will increase from area to area ; and if we make sure of a stable and expanding market and the free movement of commodities, the old markets for overseas produce will once again be restored to their full volume and even surpass it. It is the *period of transition* that matters, the interim that must elapse while the world's economy is being slowly moulded into a new pattern. During that period a few countries such as our own, may have to subsist to a greater extent than has been their habit upon their own domestic supplies of food and feeding stuffs. The prospect is by no means serious, since our own country, for instance, has obviously been able during the war to provide at least 50 or even 60 per cent. of its food. But we still have to import most of our wheat and fats and a considerable proportion of our meat and sugar. We have, in fact, been far more dependent than most of us had realized upon the foodstuffs that other countries were willing to export to us ; and we can see what this means when the world supplies of food grow short and the needs of devastated countries have to be met. It is a warning that we cannot afford to ignore. The world is changing all about us. Some countries, that had hitherto exported food to these shores, may incline to use more of the produce for their own inhabitants ; and there may soon be new competitors for the food that is already available for export. Our only safe course, in my view, is to assist in the rapid expansion of food production in the world, so as to ensure the maintenance of our own standard of living.

I now reach the stage where I must deal with the nature of the new international organization whose task it is to face a situation in which, as the promoters of that organization have themselves said, at least three-quarters of the people of the world subsist in the best of times on a diet that is insufficient for full human maintenance. Maybe this is an overstatement. But their task would still be an impressive one if we cut down the figure by 20 or even 50 per cent. Their chance of solving the problem depends ultimately upon their power of convincing the world that it must at all costs be solved.

Chapter Nine

ONE WORLD ONE FARM

WE now reach, as it were, the watershed. Obviously this book could not have been written, were it not possible at last to deal with the problem on a world scale. In October 1945, after a long period of preparation, the international Food and Agriculture Organization was established. It is known familiarly as F.A.O.

With what this new organization may or may not have achieved in twenty or thirty years' time, I am frankly not here concerned. Those who are responsible for its policy must already have some of their more remote aims in view ; but I am interested rather in the immediate tasks they will have to set before them, the problems that must at all costs be solved if there is to be any prospect of producing all the food we need.

Let us be precise. F.A.O. will, of course, be only part of the more inclusive organization of the United Nations ; and since the part has to be seen in its relation to the whole, it is quite impossible to know what F.A.O. will achieve, until we are sure how it will be related to the international credit system and to the various commodity agreements that the countries will have to arrange among themselves. The problems are complex. No country can reorganize a backward agriculture unless it has credits ; and the wealthier countries will not advance credits without some guarantee of stability and some assurance that their own farmers are not going to suffer through the loss of their overseas markets. F.A.O. is not a kind of super-national government. It can only work, so far as the various countries agree to make it work ; and this means that before any move can be contemplated all the countries concerned must be satisfied that it is to their common advantage.

But I want for the moment to ask why F.A.O. should have come into existence at this stage of all stages in human history. What has brought it to birth ? For like most other forms of life, whether social or biological, it is bound to carry

upon it the stamp of its parentage ; and it may for a time be affected by the prevailing ideas and interests that helped to mould it.

Now, as I said earlier, there seems to be a fatal tendency for any discussion on human food affairs to turn gradually into a discussion on farming and farmers. The reason for this is fairly obvious. The farmer is a definible social unit with clearly marked economic interests ; whereas the consumer of food is merely any one member of the whole human race. If he is a child, he does not even possess a vote. The farmer or the peasant, however, sees himself less as a consumer than as a *producer* of food, especially when he has to sell some portion of that food on the market ; and he usually manages to compel his government to pay some attention to his grievances as a producer. In theory, the conference that led to the formation of F.A.O. was summoned to discuss human nutrition. So its members did of course at any rate in some measure. But they found the discussion of farming topics a much more familiar way of spending the time ; and before they finished, they were dealing not only with food but with forestry, with the production of industrial crops and with the general welfare of the farming communities. In fact, more than one American writer has noticed this bias in the conference towards the *producer* end of the problem. " What we are in prospect of getting," wrote Professor J. D. Black of Harvard, " Is a foundation laid for an enduring, all-inclusive agricultural organization, that also concerns itself with the consumption of agricultural products."

But does that matter ? Does it matter that we think first of the producer of food, provided the food is produced and eaten ? Not much perhaps, so long as we recognize the full extent of the task before us. It was quite sensible to make the scope of the organization cover all the products of the soil ; and so far as the well-being of the farming communities are concerned few of the delegates would have been bold enough to suggest that this was not very much the affair of the new organization. Still, the fact remains that, while other influences have been at work preparing the public mind for the idea of a world food organization, the real pressure upon governments has been mainly exerted by the *farmers*. The great exponents of the

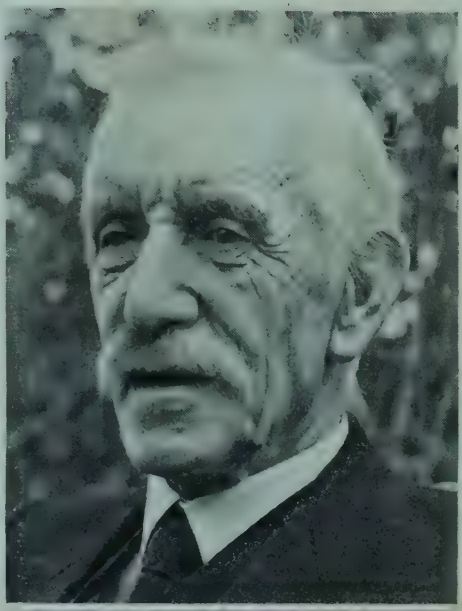
idea of a large and expanding food market have naturally been the representatives of farming interests in the food-exporting countries overseas and in the farm belts of the United States. It was they who tended to sway the conferences towards a consideration of the producer and all his manifold problems.

But while these men might have had some influence before the war upon the minds of the politicians they could only hope to gain a wider hearing for their case, when the medical evidence of poor feeding and poor health had already begun to trouble the public conscience. It was, to be precise, only where these two streams of revolutionary ideas, the medical and the agricultural, began to mingle in the early 'thirties, that the plan for a world food organization could be at last conceived. Let us trace back the movement further towards its source.

In the final quarter of the 19th century medical attention was still mainly concentrated upon the bacteriological discoveries that sprang from the work of Pasteur and his colleagues ; and the earlier surmises of the possible *dietetic* origin of some diseases were almost forgotton. But towards the close of the century medical men in the Far East began to realize what was the true cause of a few of the diseases that were associated with a low-grade diet ; and shortly before the outbreak of war in 1914 the great Hopkins in our own country and some of his colleagues on the Continent were able to prove experimentally the existence in certain foods of what they then called *accessory food factors.* In the absence of these minute *factors* or substances, which we now know as vitamins, animals were incapable of sustaining growth or even life. It was clear, in brief, that a diet might be adequate in quantity and in protein, but that it could be so poor in *quality* that the creatures ceased to grow and ultimately died.

The war that broke in upon their researches in 1914 demanded the regulation and control of food supplies in a number of countries. This gave the scientific workers some publicity (which they may not have desired) ; but it also gave them the chance they needed. Their advice was absolutely indispensable to governments that were confronted with the task of rationing a people at war ; and when in 1919 some of the industrial communities of central Europe became an almost perfect laboratory for the study of rickets, the fact that this and

Right: Frederick Gowland Hopkins (1861-1947) whose work initiated modern vitamin research.



Below: John Boyd Orr, first Director-General of the Food and Agricultural Organization.

Right : Wooden Plough in the Rice Fields of Bali.

Left : Rice Fields under Irrigatio Szechwan, China.

Right : Simple Irrigation in neighbourhood of the Yangstze.

PLATE III — DROUGHT AND DUST STORM

Above : Effect of Drought Period in Australia.

Below : American Dust Storm in Progress.

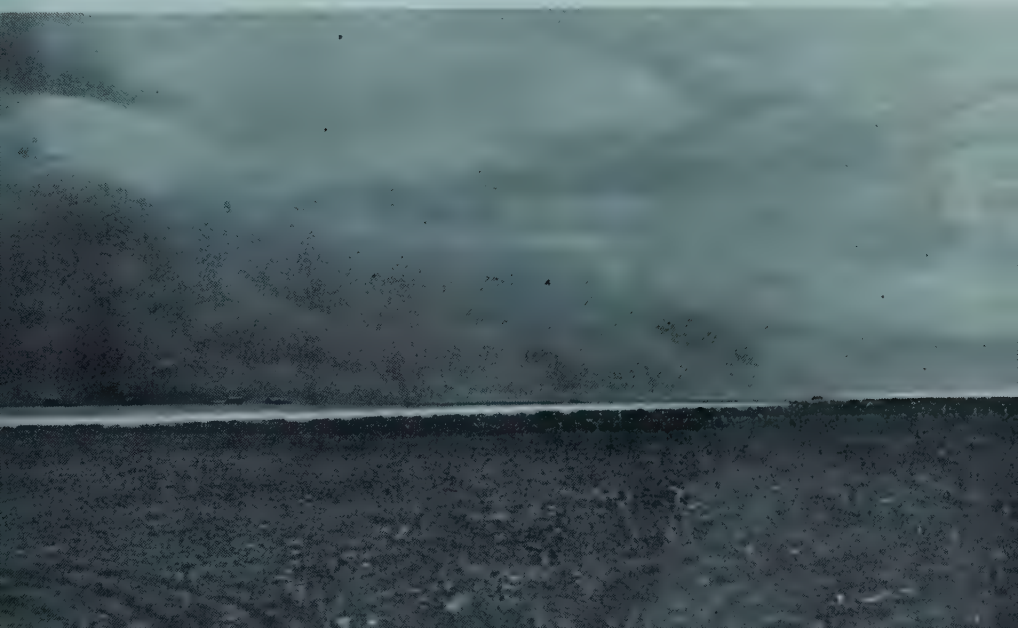
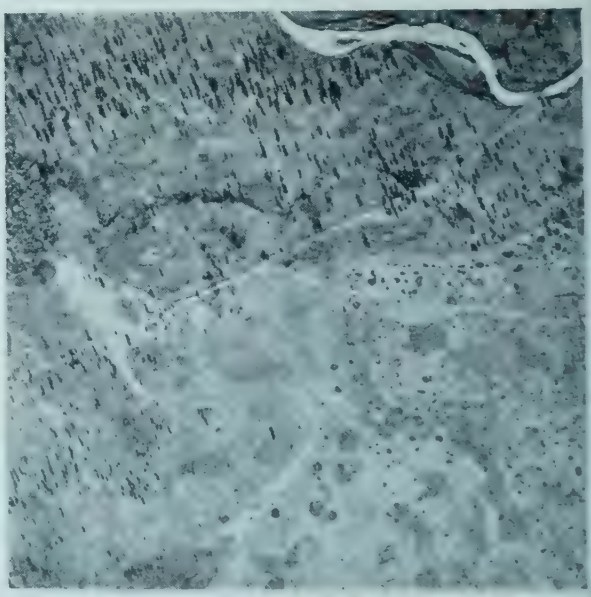


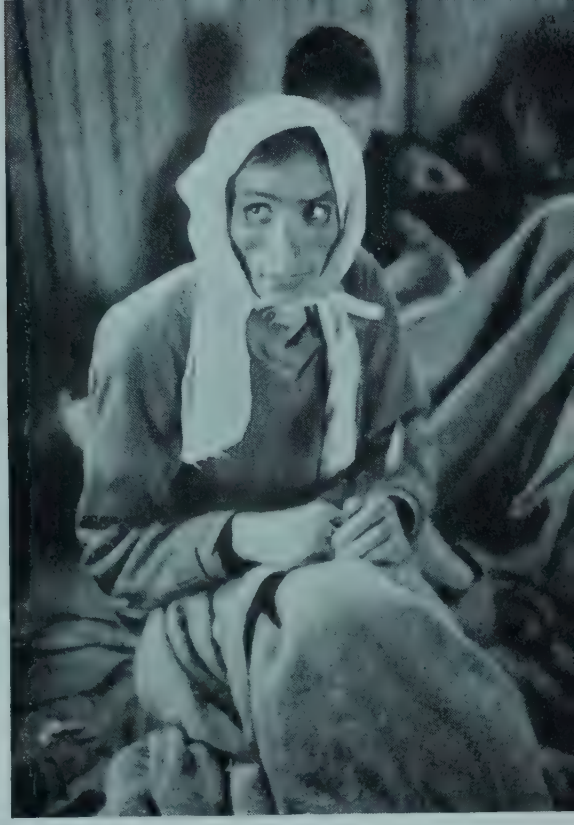
PLATE IV EROSION

Above : Eroded Hillside in North-eastern Tennessee, U.S.A.



Right : Air Photograph showing Erosion in the French Niger Colony. (Erosion has started from the small bare plateau in the centre.)

Right : Woman Victim in Belsen.



Left : Victims of the Bengal Famine in 1942.

These pictures show the same two children in advanced starvation and after recovery. On the left are those of a Greek boy of eleven, the lower being eight months after feeding began. The pictures on the right are those of a child treated by UNRRA in Sweden, the lower being three months after treatment began.

PLATE VII *HARVESTING*

Above : Air Photograph of Harvesting on a Farm in Britain.

Below : Harvesting with a Canadian Reaper in Essex.

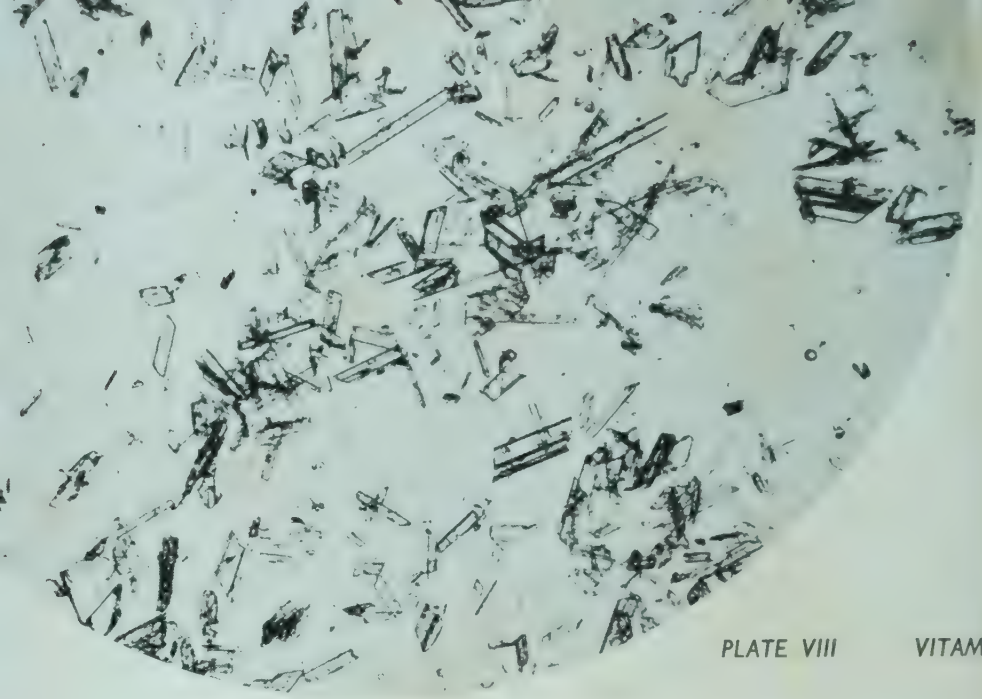


PLATE VIII VITAMINS

The pictures show the pure synthetic vitamins as crystalline solids highly magnified. The precise chemical composition of many of the vitamins has now been determined.

Above : Vitamin B.1 or Aneurin.

Below : Vitamin C. or Ascorbic Acid.

various other diseases had a *dietetic* origin could be proved beyond the faintest shadow of a doubt. It was now obvious that a properly balanced diet was by no means as simple a matter as had once been supposed ; to be safe it must be varied in composition and it must certainly contain all the essential vitamins in due proportion.

Meanwhile, in the interval since the turn of the century, medical thought had been gradually shifting from its concentrated search for the bacteria and microbes of disease, to an awakened interest in the latent powers the body possessed of resisting the onslaught of disease when it came. In the words of McCarrison, one of the early workers in the field, medicine was becoming somewhat less interested in the *seeds* of disease and somewhat more interested in the *soil* upon which those seeds might fall. The high rates of infantile and maternal mortality were troubling several of the western countries ; and the poor state of health of many of the recruits to the armed forces was giving rise to some disquieting talk about national deterioration. The possibility that prolonged ill-nourishment was at the root of all these evils began to occur to a few doctors. Child welfare became a matter of increasing importance ; and some attempt was made in a number of countries to provide schoolchildren with free meals. It was recognized that many of the low-grade specimens of humanity in the streets and at the recruiting stations were not suffering from any specific disease ; and yet they could hardly be held to support the idea that the national stock was deteriorating. What they lacked was stamina, vigour and physical suppleness. To what extent was this the ultimate result of an insufficient diet ? It seemed probable enough that it was ; and so far as the poor creatures were suffering from various minor infections, was this not due to the inability of their ill-nourished bodies to resist the encroachment of bacteria upon their tissues ?

By the early 'twenties of the century these medical ideas were beginning to attract the interest of a wider public. The experience of war had done its work ; and the rise in unemployment after the war drew attention to the low level of diet upon which most of the unemployed and many employed families were forced to subsist. Scientists could now make some attempt to measure the adequacy of a human diet ; and this

provided a yard-stick by which to assess and criticize the adequacy of family incomes. If the family income were too low to purchase a satisfactory diet, then its members would probably suffer from some preventable sickness and debility.

The need for decent clothing and houses was fully admitted ; but the cost of these items in the budget could not be so precisely estimated. Human needs in the matter of food could be estimated with increasing accuracy ; and the result was that public unrest began to express itself more and more in a demand for sufficient food. The depression of the early 'thirties brought unrest to a head on both sides of the Atlantic. Not only were the numbers of the unemployed growing month by month ; but in an effort to deal with the agrarian crises resulting from low farm prices governments were ordering the slaughter of pigs and cattle and the restriction of acreage under crops. The anomaly was too obvious to be ignored. The working classes of most of the western countries were becoming convinced by this time that they were underfed and that this economic paradox was at least one of the basic causes of war. They may or may not have been entirely correct in this. The indisputable fact is that they were convinced about it ; they assumed it to be self-evident that most men, while they may be born free, are yet too ill-nourished to relish their freedom to the full.

Many of the medical and scientific workers, who had been originally responsible for sowing the seeds of social unrest, were to some extent affected by it themselves. There were perhaps a few scientific critics during the 'thirties, who suggested that malnutrition was being used too much as a political catchword. But the conviction that something was wrong had become so widespread among all classes, that it is doubtful whether the critics were not revealing their own political bias. Yet this vague and surging mood of disquiet could not by itself shape the course of public policy. Medical men may, for instance be fairly clear about their facts ; but they do not usually embark upon political agitation ; and as a social force their numbers are negligible. No, the *real* change came at last, when the farmers began to grasp the possibility of using the social unrest in so many countries to their own advantage. That was the point where the medical and the agricultural

interests began to merge and move along a common course.

The depression of the early 'thirties had been very disturbing to the primary producers of food and fibres. Foodstuffs often found no market, except at a ruinously low price. The fact that this meant relatively low retail prices for the industrial workers helped no doubt to mitigate the worst effects of unemployment ; but that would not compensate the farming communities of Canada and the United States . In the following table, for example, I show the changing wholesale prices of wheat in four great wheat-exporting countries. The prices are expressed in cents per bushel from 1930 to 1936 ; they reveal how the market collapsed and then gradually recovered.

TABLE 2

WHOLESALE PRICE OF WHEAT IN CENTS (GOLD PARITY) PER BUSHEL OF 60 LB.

January	*Argentina*	*Canada*	*Hungary*	*United States*
1930	123·63	129·51	115·49	122·00
1931	51·99	53·62	66·17	79·25
1932	43·64	51·26	63·31	57·51
1933	39·28	38·86	53·10	48·26
1934	33·03	38·18	27·78	55·67
1935	33·72	47·37	52·31	63·50
1936	54·99	50·00	52·47	68·93

If then there were *too much* wheat, sugar or bacon for the markets to absorb, only two possible remedies could be applied. Governments must either persuade the farmers to produce less wheat, sugar and bacon, or else find some way of expanding the market for these and other foodstuffs. As I said earlier, the remedy usually adopted was that of restricting production, even if the world went hungry. The advantage of such a method is that it only requires a certain measure of agreement among a small number of the main producing countries. Its disadvantage is that it tends to break down in practice and that it satisfies neither the farmers themselves nor the insatiable multitudes waiting for food.

It was not, I think, merely a matter of chance that the first

proposal to *expand* the market for food came from Australia. A restriction in the output of wheat, sugar, mutton and wool was of little use to Australia. Her economists moved freely in British and American scientific circles ; and they were soon interchanging ideas with their colleagues in these countries. Both in America and Britain a few experiments were being tried for the disposal of surplus milk and other foodstuffs in the form of relief to the unemployed or in the feeding of school-children. Such schemes had, of course, only a domestic application within the countries concerned. They could be of small interest to countries with a large exportable surplus of food. But they were obviously of considerable benefit to farmers ; and they appealed strongly to the social concience. Could not something be done in the same way to dispose of surplus food on the world scale ?

This trend in Australian ideas is usually associated with the name of Mr. F. L. McDougall. He should have the credit for the progressive leap forward in human thought that expressed itself in the notion of " a marriage of health and agriculture." Bruce, the Australian High Commissioner, taking his brief from McDougall and enriching it from his own store of experience, laid before the League Assembly in 1935 the proposal to relieve agriculture of its excess output by directing the product into the stomachs of the underfed communities. The result was the establishment by the League of a mixed committee, which subsequently published a series of valuable reports.

No one knew much at that time about the real state of Asiatic diets. But as McDougall and the American writers had suspected, surveys soon began to show on what a low-grade diet much of central and southern Europe had been subsisting. Even if their motive for wishing to improve the diets of Europe was not quite an altrustic one, there was nothing improper about it. Clearly the only way to improve the value of the average European diet was to persuade the farmers to grow less cereal and sugar beet and to go in for more stock-raising and dairy husbandry. If Europe became as a consequence a good market for overseas wheat, maize and sugar, the benefit to the overseas farmers would be obvious ; but the benefit would also be mutual.

McDougall and the other reformers natuarally came in for criticism from commercial interests and even from some sections of the farmers. Tolley, for example, who was later to take charge of the Agricultural Adjustment Administration in the United States, found himself in the early 'thirties in conflict with the dairying interests in that country over his suggestion to divert surplus fodder towards an increase in milk production. The problem grew rather complicated, as it often tends to do in farming circles, where the interests of various types of producers have to be reconciled. Many of the European countries were, of course, set on a policy of self-sufficiency in the basic foods ; and the large overseas producers still doubted whether it was wise to leave behind them the restrictive policy that they had adopted. In any case, no solution had been found by the time the Germans crossed the Polish frontier in 1939.

In the spring of 1943 a conference of the United Nations was called at Hot Springs, Virginia. Why the United States took the lead in summoning this conference is a matter for speculation. McDougall, Tolley and their friends had been busy at Washington in the autumn of 1942, insisting that freedom from the want of food was what the world needed above all other benefits. No one was quite prepared to deny it ; and food at all events was a subject that could be discussed concretely and statistically. But the countries of America with their exportable quantities of wheat, maize, sugar and animal products were already beginning to consider what the post-war demand might be among the importing countries. If the period of social reconstruction in Europe after the war could be accompanied by schemes of agricultural reform, Europe could in theory provide a very convenient market for some of the products of American farms.

In any case, the conference soon showed the usual bias of such conferences towards the agrarian way of thought. Obviously the driving force behind the whole movement had come from the men who embodied the hopes and fears of the farming communities in several of the more advanced countries. What McDougall, Tolley, Orr and their friends had contributed towards the solution of the problem was simply the realization that it had to be handled on a grand and universal

scale. In brief, the problem had to be internationalized if there were to be the slightest prospect of a stable solution.

From their point of view the first thing to work for was continuity and they concentrated their efforts on getting an interim commission established. This interim commission would have to hold out, until it could secure agreement among the various countries on the setting up of a permanent organization. The interim commission did, in fact, draft a constitution. At Quebec in October 1945 the new international organization came at last into existence and defined its goals.

We must be quite clear on the limitations of this Food and Agriculture Organization as it has emerged after more than two years. It is, as I have said, in no sense a *super-national* body, in that it cannot lay down national policy ; it is not even an *extra-national* body, in that it depends for its funds upon the contributions of its member nations. There were at one time some who supposed that it would be an " operating " body and would, in effect, handle the various commodity agreements between a number of countries so far as these were concerned with agricultural products. It now seems more probable that these agreements will be developed under a distinct organ of the World Organization ; and there may be some reason for such a policy, since many commodities in the world market are outside the range of farming. One may doubt, indeed, whether the functions of the F.A.O. are at present conceived as other than advisory. Its budget for the first five years is extremely modest ; it will rely for a proportion of its experts upon the loan of their services by their own countries ; and it can manifestly assist in the economic reorganization of any one country only by the invitation of its government.

When an instrument of this kind is in process of formation, one looks for the elements in it that will direct its lines of growth. Pearson, the Canadian chairman of the interim commission, remarked in one place on the importance of its director-general. " He can," he sad, " either mould F.A.O. into a respectable fact-finding body, following discretely in the rear of world opinion, or into a dynamic force, clearing the road towards a better fed and healthier world " ; and he made some reference to the contrast between a supply truck and a bulldozer. This is true enough as far as it goes ; and, as Pearson himself

added, anyone who has had experience of the workings of the League of Nations or of the International Labour Organization, will look closely into the structure of the new body. But a comment of this kind means only that the organization will have to claim and to merit the support of mass opinion in all countries. It is the peoples who will bulldoze their path into the future, using F.A.O. as their scientific machine for the purpose ; and they will succed only so far as they insist on diluting national sovereignties with a wholesome strain of internationalism in practice. Meanwhile F.A.O. emerges as an almost purely fact-finding, fact-publishing and advisory body. If the facts are published without restraint and the advice based upon them is clear and cogent, it will find the support it needs ; and the support it needs will have to be expressed through larger funds and a widening range of powers. The organization still bears the marks of its origin. On the administrative side and in the field of wholesaling and marketing it remains weak and uninformed. It is weighted towards its traditional agricultural bias ; and its medical and physiological experts seem still to be suspended within a world of their own. The first task for Sir John Orr, the director-general, will be to fuse the parts of his machine into an organic whole and to increase its theoretical grasp of the problems of market supply, processing and manufacture.

In fact, it should by this time be obvious that our task is to bridge the gap between the producers and the consumers of food. The production of food can be vastly expanded by the use of modern scientific methods. But it cannot be safely expanded, unless consumption levels are raised to absorb the food produced. Consumption levels can only be raised by solving the problems of marketing and distribution, by expanding, that is, the existing markets and by opening up fresh markets among the backward communities of the world. In other words, we have to organize the world distribution of food on some more rational basis ; and that involves an attack from one side or another upon the fundamental problem of poverty.

Chapter Ten

THE FEAR OF ABUNDANCE

FOR more than a decade before the war the farmers of several countries were haunted by the fear of producing unmarketable quantities of grain or sugar, the effect of which would be to depress farm prices. Temporary gluts of fruit or milk, vegetables or fish were often no less inconvenient for the producers. Farming policy was, in consequence, dominated in all the major producing countries by the urgent need to *restrict* production within the limits imposed by the available markets ; and these markets were themselves limited by the poverty of a large number of consumers.

If the living standards of most of the human race are kept at the present low level and are liable to be even further affected by industrial depressions, any country that embarks upon an *expansive* farming policy will come up against the same problem of unmarketable surpluses of food. The government may then decide to encourage the use of surplus grain or potatoes to produce more bacon and milk. From the nutritional point of view this would be highly desirable ; but what benefit would it be to the farmer, if it only ended by leaving unsaleable milk and bacon on his hands ? Yet we cannot wait for the process of world reform to run its course and the demand for varied foods to rise before we take measures to improve and diversify farm production.

We must begin *now* to reverse the fatal trend towards restrictive practices in our farming. The need for varied foods in the world is virtually inexhaustible. We have to produce more eggs, milk and meat ; we have to convert suitable land into good grazing areas ; and we have to raise the level of grain yields in several parts of the world. But if farmers the world over are to adopt this expansive basis of food production, they will have to be sure that all their produce finds not only its market but its stable price.

Now, it is clearly preferable that the process of raising farm production and that of industrialization should develop

side by side ; and that both should be accompanied by an improvement in wage levels. But there can be no guarantee that they will move precisely in time with one another ; and what we now require of our economic plan is that it should intervene to help the farmers wherever crop production or the production of milk or meat outruns the immediate capacity of the market to absorb them. It is true that the rising levels of output would have to be controlled to some extent ; and they could normally, of course, be controlled from year to year without calling up the spirit of restrictive practices from the depths of the past. But seasons vary from year to year ; and the yield of crops cannot always be kept within controllable limits. The question is whether we can contrive a reliable plan or mechanism for relieving the farmers of any surplus produce for which they can find no markets.

This may not sound a very momentous proposal ; but we might as well be realists. The fact is that this problem of how to dispose of farm surpluses without burning them is the core of the whole matter. If we cannot solve it, we might as well shut up shop.

It was in the years following the 1914-18 war that the Western Hemisphere was first oppressed by the problem of unmarketable wheat and sugar. Had the countries of Europe been prepared at that period to grow comparatively little wheat or sugar beet, and to rely rather on importing the products from overseas, the West would have been content ; but Europe both restored and expanded her sugar beet production ; and the economic depression that lay half-way between the wars, not only arose in great measure from the chronic poverty of overseas farmers, but made matters worse by releasing the agitated peoples of Europe on their career of economic self-sufficiency. They grew not less wheat but more ; and the effect was to make the large producing countries overseas think only in terms of a restrictive agriculture. Acreage must be reduced ; and farmers must if necessary be paid *not* to grow wheat or breed pigs.

Naturally enough, the argument to-day in the countries overseas that grow wheat, maize and sugar cane, is that Europe would be far better off if she produced more meat, milk and eggs and imported a large proportion of her bread-grain,

sugar and feeding stuffs. This is perfectly true. But with Europe in her present mood the stages of transition are bound to be slow ; and the argument assumes that the industries of Europe are going to find ample markets overseas in order to pay for all this flow of imported food. In brief, it assumes that we are already approaching our goal of a free and prosperous world trade. This concentration upon the idea that the Old World of the white races is the only market for restoring the balance of the New may well lead to a phase of disillusion and recrimination. Europe is fated to traverse a period of slow and shifting recovery ; and meanwhile there will be seasons when surpluses of wheat or sugar, bacon or cheese, begin to accumulate in one or more of the overseas countries.

Such proposals as have been made to deal with a contingency of this kind will not satisfy all the conditions. The usual method before the war was to attempt to fix an export quota for the main exporting countries and to leave the various governments to argue it out with the farmers. This, of course, was the essence of restrictive agriculture. The interest of the governments led them to satisfy the farmers as best they might, in that the farmers were an influential section of public opinion ; and various devices were contrived, such as export subsidies, farm subsidies and a price system that at times held the retail price of bacon or sugar on the home market at a level two or three times higher than that on the world market. In other words, the home consumer had to be sacrificed to the interests of the producers ; and, moreover, where any attempt was made to stabilize world prices (always a reasonable enough aim in itself), the consumers abroad found that they never reaped the advantage of a good season and a convenient fall in the price they had to pay.

But there are some elements of value in the latest of these agreements, the draft agreement on wheat that emerged in 1942 from a discussion among the main producing countries, Britain participating as the chief importer of wheat. This agreement will have to be recast within the mould of the new international organization. It has many obvious weaknesses ; it makes, for example, no provision for a gradual improvement in the efficiency and so in the cost of production ; in

brief, it would tend to maintain wheat farming in several countries at its present inefficient level. But the agreement does at least suggest, that ample stocks should be bought by governments in good seasons and held in storage against a poor harvest. The advantage is obvious ; a good harvest means a glut with prices falling even below the cost of production, unless someone relieves the farmer of his surpluses in time ; and in a bad year the consumer may find himself paying scarcity prices, unless somone has a reserve stock that can be released on to the market at the critical moment. To a limited extent this plan of holding " buffer " stocks, as they are usually termed, can be applied to all foods that are not perishable ; and in many cases perishable foods can, of course, be dried and preserved. The peculiar value of the plan for a hungry and unpredictable world, is that it will enable us to deal immediately with any natural disaster, such as a local famine, a flood or an earthquake. The stocks we shall hold, not merely of wheat and sugar but possibly of dried milk and dried meat, will give us a reserve from which relief supplies can instantly be conveyed by air to the distressed populations ; the world would at last have its reserve larder and so insure itself against any but the most prodigious famines.

The plan has, however, its limitations. The " buffer " stocks could not be permitted to rise to inordinate levels ; and many countries may be unwilling at first to commit themselves to heavy purchases. There might be a succession of good harvests ; and, moreover, farmers have an incorrigible way of expanding production of any foodstuff for which they think there is a safe market. Much can be done by adjusting the prices paid to the farmer and by other means to check this tendency ; but the process will be a slow one. The only sure method of disposing of such surplus sugar, bacon or wheat as still remains is that of handing it, quite simply and without disguise, to consumers who need the food but are too poor to purchase it at the normal price. That is the obvious solution for the problem ; and what we require is a scientific plan for making it work on an international scale.

In a few countries and particularly in the United States experiments have recently been made in the disposal of surplus food among the needy classes of the community. That the

United States should have become the classical example of this kind of experiment is due to a complexity of causes. The country was burdened in the last decade before the war with unmarketable surpluses of such foods as meat, butter, milk, peanuts and fruit ; and the extent of poverty and unemployment was too obvious to be denied. The scheme began in 1933 and until 1939 the food purchased by the government agency was distributed in the form of direct relief. But even in these early stages varied foods were affected. In 1933, for instance, a portion of the pork made available through the emergency slaughter of pigs was utilized for this purpose ; and a large butter surplus, that had been acquired by the government in an effort to stabilize prices, was disposed of along the same channels. In the four years that ended with 1938 over a million tons of food had been diverted to relief ; and of this total, meat made the largest item. But the quantity of food thus diverted never rose above 5 per cent. of all food marketed within the country and usually it was well below this proportion.

In 1939 the scheme was revised. The food was no longer to be distributed in the form of direct relief ; it was to be sold to families deemed necessitous, through the medium of a special " blue stamp " plan, the method being so devised in theory as to ensure that the families would acquire the more nutritious foods. At the same time the provision of school meals was rapidly expanded and they were in some measure embraced within the scheme for the disposal of the surplus foods. The results were gratifying both to the authorities and to the public. Not only was a certain stability given to farm prices, but inquiries seem to have indicated that the scheme with its promise of better nutrition had a surprising popularity among the people of America. The number of those eligible to receive the " blue stamps " gradually expanded, though there was naturally a considerable decline as the war proceeded. But by 1942 the participants were approximately 2,600,000 ; and they included mothers receiving pensions, old age pensioners and the unemployed in receipt of public assistance.

It was obvious that the success of the plan would suggest to a few scientists, especially in the United States, that it might in theory be extended into the international field. But

CANADA
WHEAT 4,800,000
BACON 70,000
MEAT 61,500
ATLANTIC OCEAN
WHEAT 1,300,000
U.S.A.
MAIZE 850,000
RICE 210,000
BACON 31,000
MEAT 69,000
MEXICO
COFFEE 40,000
CARIBBEAN AREA
SUGAR 3,900,000
VENEZUELA, COLOMBIA, ECUADOR
COFFEE 300,000
PERU
SUGAR 340,000
BRAZIL
COFFEE 870,000
MEAT 61,000
RICE 55,000
PACIFIC OCEAN
ARGENTINA
MAIZE 7,000,000
WHEAT 3,300,000
MEAT 663,000 (& Uraguay)
FOOD EXPORTS from AMERICA (in tons) Average 1934 - 38
·BSL·

there are many difficulties to be overcome. A scheme for relieving farmers of 2 or 3 per cent. of their butter, meat or fruit and of diverting it by purchase out of taxation to the feeding of schoolchildren or unemployed is not likely to give us much guidance on the world market with large surpluses of wheat, maize or sugar. The principle, however, is an important one ; and the principle is that of establishing a kind of *double market*. If food is to be bought from the farmers in order to maintain the normal market price they would receive for most of their produce, then it is only reasonable that it should be bought by the State at a lower, and often much lower, price than they would usually obtain. The State can then sell it again at a price that will just cover the costs of purchase and transport. The question is whether there are populations in the world, who would willingly take the wheat or sugar at a low price but would be unable to purchase them at the usual price in the world market.

Undoubtedly there are such populations ; and for the moment we need look no further than to the millions of China and India. In the northern parts of both these countries other grains than rice are normally grown and consumed ; in India, for example, the proportion of rice-eaters to the eaters of wheat, millet and other grains has been estimated as about 240,000,000 to 100,000,000 while the proportions in China would be of the same order. Between the rice-eating and the wheat-eating areas lie broad belts of population, where both kinds of food are eaten and the choice between them is influenced mainly by price. The difficulty is that in both countries poverty compels people to resort frequently to less nutritious and certainly less attractive grains such as millet or maize ; and it seems beyond doubt that we have here a large potential market for any wheat we care to ship there and distribute at a sufficiently low price.

The possibility of employing this method of disposing of surplus grain, sugar or bacon is precisely the problem that modern science has to solve. It is the only practicable way of dealing with such surplus food as the farmers happen to produce, except that of destroying the crops ; and if we do not adopt the method we are proposing, we shall embark on a further period of restrictive agriculture, in every sense a

most lamentable prospect for a hungry world. It is clear, of course, that certain measures would have to be taken. The transactions would have to be from government to government ; there would have to be a guarantee that the food was, in fact, sold to the people who needed it at the lowest possible price, and that it would not be diverted back into the world market by speculative middle-men. There seems no reason why these conditions should not be satisfied, provided only the necessary funds are made available to cover any deficit that may result.

To put the matter briefly, farming can never be so regulated as to ensure that production will not exceed the world's power to purchase ; if we are to adopt an expansive agricultural policy, production is sure at times to overflow the limits of effective demand. The excessive production may be checked by various devices ; but, unless these devices are restrictive in character, we shall inevitably find ourselves faced with unmarketable surpluses. Our only solution is to plan, both internally and in the international field, to dispose of such surpluses where they are needed. It will be the business of each government to contrive methods of disposing internally of occasional gluts of fish, fruit and milk ; in the international field the problem can only be solved if the nations agree to give some surplus disposal authority the control of the necessary funds. How these funds are to be made available is for the nations to decide. But if they are not made available, farming will still be haunted by the shadow of a restrictive policy.

I have insisted that this problem of the disposal of surplus food is the core of the whole matter. The surpluses have mainly occurred in the large exporting countries ; and it must be realized that it is precisely these countries that will be asked to advance credits for the reorganization of agriculture in the more backward countries. Now, if we assist to industrialize these more backward countries, and to reorganize their agiculture, it should have the effect of expanding the world market for food. But what proof have we of this ? The overseas exporters may fear that, if they assist other countries to reform their farming, it will mean a contraction of their own markets ; and in that case they will bring pressure upon

their goverments to withold the necessary credits. Our only safe course is to convince them that they will not suffer ; and to my mind this can only be done through a plan that will guarantee them the disposal of inconvenient surpluses.

It is strange to be writing of surplus grain, sugar and bacon in the midst of a world famine. But let us recognize that even in four or five years' time we may again be faced with the problem. To some extent the very fear of having surplus stocks left on their hands at the close of the war, helped to produce in overseas countries the conditions that have led to famine. We are suffering for the sins of the past ; and the famine is itself a warning to us not to curb too far the natural powers of our soil to produce all the food we need.

Chapter Eleven

THE FARMING REVOLUTION

IT is obvious that all countries ought to adopt the practice of producing and consuming their own milk, eggs, vegetables and bacon, at any rate as far as their soil and climate will permit. This is clearly the real basis of a good varied diet. Milk, eggs and vegetables are best produced as close as possible to the homes of those who need them ; and as for bacon, most towns can usually organize the collection of swill sufficient to support a few piggeries. But while the people of many countries, China for example, or Hungary, Nigeria or Siam, would certainly benefit from this kind of mixed farming, the problem is how to get it going.

Mixed husbandry with stock rearing on the modern pattern will have very distinctive forms of growth in Siam, say, and Rumania, in Cuba and the Gold Coast. Our best plan is to take a region, such as that of the countries of south-eastern Europe, and study it in some detail. The problem had reached an acute stage in this region before the war ; and it remains the same basic problem, whether its solution is attempted under Soviet or Western influences. The problem is a complicated one, because it is mainly one of poverty. That

is to say, the peasant farmers of the Balkans have had no urban market of any size to absorb milk, meat or eggs, still less do they provide any market themselves. To suggest drastic changes in land tenure or in the size of holdings as the only solution, is merely to put the cart before the horse. There must be a market for the food that is to be produced ; and moreover, that market has to be found either in the country itself or in some newly industrialized country.

It would have been little help to propose to Yugoslavia or Rumania that they should adopt Danish farming methods and sell dairy and bacon produce abroad. There *was* before the war no foreign market for such foods of any capacity except the British ; and the British market was already insufficient to absorb all that Demark and Holland could have produced. The only safe course for the Balkan peasant was to export his wheat and maize to feed the more prosperous communities of the West, often, in fact to be processed into pork or butter for the British or German consumers. As far as many of the western European countries were concerned, they were deficient both in bread-grains and in feeding stuffs. Holland, for example, before the war imported 60 to 75 per cent. of the grain she needed for her stock-feeding, while Denmark imported at least 30 per cent. of her wheat. Some proportion of this grain was grown in the Balkans, which were thus retained as a kind of colonial area of exploitation, subsisting as a whole on a wretchedly low standard of living. The people exported the grain that should have been processed into milk and bacon for their own benefit.

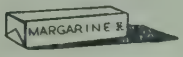
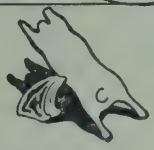
Part of the trouble, as we have already hinted, is that relatively little of the growing population of these south-eastern countries had been drawn off into industry, as were the surplus populations of the West. The result is that the farming land of the East has become desperately congested. That is to say, the land has to provide both work and maintenance for a far larger population than it needs. Few peasants could afford to acquire modern equipment or good breeding stock ; and even if they could, what use was there in so re-organizing their production that half the family would be unemployed ? It was estimated that, if somewhat over three acres is sufficient in these countries for a man's subsistence, there must have been

more than 14,000,000 surplus rural population by 1931 in eastern and south-eastern Europe. By the outbreak of the war this figure would have increased to close on 18,000,000 or the equivalent of 40 per cent. of the population of our own country. At least a third of the farm population of Poland and Bulgaria, could probably have been withdrawn without affecting in the slightest degree the level of production, even if the traditional methods of farming were still retained. The over-population was, in brief, merely a form of concealed unemployment. But because the unemployed of these countries were wasting their time on farms instead of about idle factories or mines, they were not therefore to be envied ; necessarily the surplus mouths had to be fed and it is far cheaper to consume maize and potatoes than to convert them into meat or milk.

We might express the problem of rural congestion in another way. In our own country we produce relatively high yields with a small labour force. We have needed, in fact, only about six active workers for every hundred acres of farm land. But in such countries as Italy, Poland, Rumania and Bulgaria there are over fifteen active workers to every hundred acres ; and the cash value of their labour is low. Rumania and Yugoslavia were in 1937 extracting no more than £3 worth of produce per acre, whereas the value of output per acre in Denmark was at least three times, and that in Belgium or the Netherlands at least four times that figure. It is scarcely surprising that the south-eastern countries were not only living on a predominently vegetarian diet, but were not in any sense competing efficiently in their exported grain with the overseas producing countries. No more than 10 or at best 20 per cent. of the main crops could be exported, since the large proportion must of necessity be consumed where it was grown. Land which could in theory carry a much higher head of stock had a half or even a third the number per acre, that could be supported by an acre of land in western Europe.

The proposal that this measure of over-population should be relieved by a planned industrialization has certain primary difficulties. Industrial labour in these countries has naturally been cheap ; and its wages have not been on a sufficient level to offer the peasant a good market for his food. On the

PRE-WAR AVERAGE WEEKLY DIETS OF BULGARIANS AND AMERICANS

FOOD	BULGARIA	U.S.A.
BREAD ETC	9½ LBS	3¾ LBS
POTATOES AND ROOTS	½ LB	2⅘ LBS
SUGAR	1/6 LB	2 LBS +
 FATS	¼ LB	¾ LB +
PEAS AND BEANS	¼ LB	⅖ LB
 MEAT	1 LB	3¾ LBS
MILK	4 PINTS	6½ PINTS

other hand, the poverty of the peasant offers no market for the clothing and light metal industries upon which such a policy of industrialization would have to be based. The problem is where to make a start. The market must, as we have seen, be mainly an internal one, limited to intercourse among the countries concerned. It can only be matured gradually with some considerable measure of State planning and with assistance on an international scale. The peasant of eastern Europe has at the moment to concentrate upon his traditional habit of extracting from his land all the grain and roots that it will yield. In the present state of food supplies he has no other prospect ; and whatever be the form of agrarian revolution that is now taking place in these regions, old methods of cultivation and farm economy will die slowly. If a market for grain is re-established in western Europe, some guarantee is needed that the produce of the Balkans will not meet the competition of a flood of grain from overseas.

But it should in any case be the business of an international organization to protect a backward economy in transition against sudden shocks, especially where it has been the custom to obtain industrial imports by the sale abroad of large quantities of one or two crops, sugar, for example, or maize or oil seeds. It should thus be one of the tasks of the international organization to negotiate agreements among the countries, so that exports rise or diminish from area to area according to a graded and flexible timetable.

The essential thing, however, is that governments in these peasant countries should so adjust the wage levels in their developing industries as to attract from the farms a steadily rising flow of animal products and vegetables. At the same time the price of industrial products would have to be adapted to the income of the peasant. This adjustment of farm and industrial prices is a process relatively simple to manage in a country where both urban and rural workers are starting from a low standard of subsistence. A large degree of planning is inevitable in the early stages, since the two branches of the economy have to keep pace with one another. Once the process has been set going in a country or in a group of countries, that have entered into close commercial arrangements, various schemes can be applied to accelerate it.

It has, for instance, been recognized that the river system of the Balkans will have to be used to better purpose, if the region is to be provided with cheap sources of power and properly irrigated. Whether the capital outlay and the initiative come from the west or the east is of little moment. Both the U.S.A. and the U.S.S.R. possess the necessary technical experience. But it is clear that such an undertaking would have a profound effect upon the whole economic and political life of the region, since the schemes would inevitably tend to traverse national frontiers and involve the establishment of international controls as, for example, a Danube Valley Authority. Moreover, the untapped farming resources of the various countries would at last be made accessible. The matter is important to ourselves, because we need to know how far and for what type of produce these countries will still be able to export into the world market. The climatic conditions are certainly unfavourable in some areas ; but they could be overcome by irrigation schemes ; and so far as they were overcome the yield of such crops as wheat and maize might well be doubled. There are marshlands that could be drained ; and the whole area is scattered with hill districts that could be cultivated and re-seeded so as to carry a good head of stock. On the whole, however, it seems probable that eastern Europe will continue for a time to be to some extent, a continental granary and will develop an additional foreign trade rather in dried and processed fruits and in wines than in live stock products or sugar. It will need all its live-stock products for the feeding of its own inhabitants.

It is inevitable that, when a region shifts towards a policy of satisfying first its own dietetic requirements from its own soil, its foreign trade will temporarily decline. If it is a relatively poor country with no mineral wealth and few industries, its imports will have to be carefully controlled and selected ; and a judicious government will presumably seek to import such farming or industrial machinery as will assist in its plan of development. In other words, there can be little or no luxury buying abroad ; and in consequence no leisured class of the community can be given free license to buy what and where it desires. This aspect of an economy planned for a rising level of dietetic standards is only an expression of the fact that

purchasing power has to be more evenly distributed. But it is necessary to comment on it once again, because the scientific studies of the problem tend to ignore it. A large country with an abundance of natural resources and a highly developed industry, such as the U.S.A., can make use of a margin of taxation for the disposal of surplus food, the promotion of school meal schemes and other indirect but effective methods of raising the dietetic standards of its people. A poor country has no such means of solving the problem. It may initiate some welfare food schemes in a modest way ; but its task is not that of taxing 20 per cent. of its population to feed a depressed 10 per cent. adequately, but that of raising the food standards of 90 per cent. of the population in greater or less degree. Any country that has to deal with a large percentage of untaxable incomes must have recourse to a planned process of revolution, which involves an evening out of income levels to some extent, as well as the adoption of a common way of life that is in the main simple and rustic ; and this dictum is true for a great part of Asia and South America, as well as for the south-eastern and southern regions of Europe.

But the process of transforming the peasant population in many diverse regions and races can clearly have no common pattern ; each region has to be studied for its own peculiar solutions. In some cases there is need to consolidate the mass of small and uneconomic holdings that have resulted from the gradual parcelling out of land ; in others the large estates will have first to be broken up into holdings of suitable size, in the prospect that various forms of co-operative farming will later develop. Especially will it be necessary for governments to relinquish their traditional belief that the peasant or the primitive cultivator, as we know them, should be preserved as a heritage or survival, as a stabilizing factor on the community or as a source of man-power in case of war. The peasant working for his own subsistence has become an anomaly in our modern civilization ; and he must be replaced by the farmer producing in part for a food market, in which he himself has a share. It is, as we have seen, the provision of a market for varied farm products, that is the pre-requisite in any process of transformation we may wish to initiate. The market is based not upon the chance demands of an im-

poverished community but upon a deliberate policy of raising dietetic standards ; and it is precisely such a policy that has to be promoted through an international agency.

But we cannot say, along what course the farming revolution will flow in any country or region of the world. The conditions of climate, soil and custom vary too much ; and while we may well study the experience of countries where modern farming practices are already established, it would not be safe to theorize that Danish, Russian or New Zealand forms are applicable. The measure in which co-operation will be adopted in crop-raising, in marketing or in the processing of milk and the grading of fruit will depend entirely on the inclinations of the farming community. A government may assist in the process ; it can scarcely enforce it upon a community that sees no particular reason for it. Where industries develop in towns that are more or less remote from village life, there is some probability that farming organization of this nature will emerge, as it almost certainly tends to do for an export market. But where there is a growth of small and efficient industries among the villages, the need for such co-operative enterprises would be far less obvious. At all events, the movement is likely to be a more gradual one.

To persuade mankind to feed itself well, we have first, then, to give it assurance that it will not starve on the path to abundance by sacrificing its traditional methods of cropping and cultivation ; once we have given it this assurance by providing a stable market and an ordered world, we need do little more than water the vegetative growth of " new model " farming with judicious subsidies, loans and, above all, such varied forms of instruction and advice as are available to us. If we further wish to influence the pattern of farming practices in any country, we can certainly do so by capitalizing large-scale hydro-electric and irrigation schemes ; but that is of less moment than the immediate task of relieving the land of its surplus population and converting the surplus into a stable urban market for meat, milk and vegetables.

Chapter Twelve

WOMEN AND CHILDREN FIRST

WE have so far considered schemes for expanding and varying the production of food ; and it has become clear that the essential measure we must take is to provide a stable and expanding market for the food that is to be produced. There are, however, schemes in operation in a few countries, to which the term *nutrition policy* has been specifically applied. I have already mentioned certain of these schemes ; but it would be useful to examine them further to see to what extent they are practicable. They usually appeal to the medical mind as being the obvious lines upon which we should develop our policy as a whole.

The plan is to devise administrative schemes for the provision of milk and other nutritious foods to such special classes of the community as children, pregnant women, nursing mothers and so forth. As far as we can see, there is no theoretical limit to the expansion of schemes of this nature to cover a large number of beneficiaries ; one might, for example, extend them to widows, to adolescents, to certain categories of workers, to invalids and to aged persons. All we should require for our purpose is a definable physiological group ; and the only limits we should discover in practice would be set by the available food resources and the patience of the taxpayer.

Reforms of this kind among the civilized countries of the world have been varied in their origin. They were, of course, mainly conceived in the first instance as devices for the provision of relief in kind to necessitous groups of the population. It is only in recent years that a subtle change has come over the quality of the service ; and it has needed a war to give substance to the change. The trend is away from a mode of selection based merely on income, and towards a mode of selection based on physiological principles. According to modern theory in our own country, for example, a pregnant woman

establishes her right to low-price milk not because she is in poverty, but because she is pregnant. A child is provided with free milk at his school, simply by virtue of being a child. This is a significant shift in emphasis. It has become embodied in references in official literature to the *vulnerable groups* of the population, those who are, in other words, exposed by their age or condition of life to special dietetic risks.

Now, if we adopt this medical way of looking at the matter we entirely ignore class and income distinctions. The principle of charitable relief, is replaced by a new principle of social responsibility ; we are expressing in dietetic terms the interest the community is bound to feel in the welfare of its children or its aged persons. If we carry the application a little further, we convert the benefit from a symbol of degradation to one of social esteem. The question whether ultimately we shall need schemes of this nature if all families have a sufficient income to purchase the food, we can leave to future generations to decide for themselves. There is no reason, as far as I can see, why selected foods should not be provided in this as well as in any other way ; and medical theory insists that, as far as children and their mothers are concerned, no amount of good feeding later in life will probably compensate in full for defects in the early diet. There is every argument, in the meantime, for dealing with the more obvious defects in human diet through these and other direct measures of reform.

I have touched briefly on the problem, when I discussed the disposal of surplus foodstuffs. But the schemes reach far beyond the mere disposal of surpluses. They may even start as a means of disposing of such surplus food and later find themselves seriously limited by their origin. The scheme in our own country for providing schoolchildren with milk at half the normal price was initiated for the disposal of an unmarketable quantity of milk. Its effect upon the health of the children was doubtless felt to be beneficial ; but its intention was that of relieving farmers in a country where almost 30 per cent. of annual farm incomes was derived from the sales of milk. When the rising demands for protein foods in time of war began to absorb the total milk yield of the country, school milk had to be made a priority ; and a priority

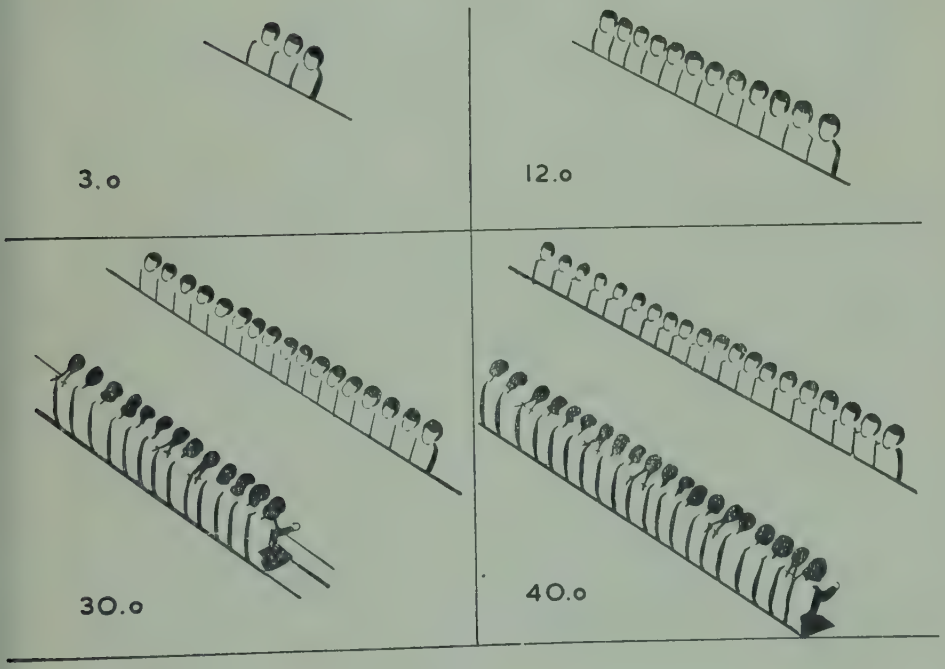
it will probably have to remain for some years to come. The domestic consumer will meanwhile continue to be rationed.

In any case, whether or not war has resulted in a temporary shortage of food, welfare food schemes of this kind can never be made a permanent channel merely for the disposal of such milk, butter or dried fruit as happen from time to time to be unmarketable. The whole plan tends to break down, as soon as the schemes have become well established. The health and education authorities, and the social workers who usually have the task of administering the schemes, are less interested in the markets needed by the farmer than they are in the dietetic well-being of the child and its mother. As far as they are concerned, the foods provided may or may not be surplus to the normal market. What they require is that the foods shall be provided regularly in sufficient quantities to meet the demand.

Two years after the Surplus Marketing Administration in the United States began to operate systematically in the field of the school meal service, it was already apparent that the meals would have to be viewed as a nutritional and not simply as an agricultural measure. In any case the authorities had to purchase considerable quantities of varied foods beyond such as were available from the surplus stock. In the meantime, the amount diverted from this stock for the feeding of schoolchildren and increased enormously. In the year 1937, while the authorities were still experimenting with the methods of disposal, somewhat over 1,000,000 lbs. of varied foodstuffs had found their way into consumption through this channel. By 1940 the amount had risen to 14,700,000 lbs. ; and by the middle of 1941 it had reached an annual figure of 56,500,000 lbs. The number of children participating in the service had increased in the same period from approximately 350,000 to approximately 4,700,000. There is little need to comment on these figures. They suffice to show that the meals were becoming a social institution. If they persist in the years following the war, the Federal Government will have finally to revise its attitude towards the scheme ; it may be able to adjust the scheme to the movements of farm production ; but the primary consideration will have to be the dietetic welfare of the children themselves.

GROWTH IN PERCENTAGE OF SCHOOL CHILDREN RECEIVING SCHOOL MEALS IN GREAT BRITAIN

PERIOD	SUMMER 1940	SUMMER 1942	SUMMER 1944	SUMMER 1946
PERCENTAGE	3.0	12.0	30.0	40.0



Now, there is a natural tendency both in this country and in the United States to see in the willingness of other governments to promote similar welfare schemes, an evidence of their intention to take their nutrition problems seriously. The governments concerned are held to have given some token of their desire to raise the dietetic level of their peoples and so to be worthy of international encouragement. There is probably some justification for this point of view. Schoolchildren, for example, or adolescents working in factories and offices are readily organized to benefit from any service we care to render them ; and it is commonly agreed, as I have said, that a body well nourished during its formative years should in most cases mature into a hardy and adaptable consumer of food. Would it not be as well to concentrate internationally upon the promotion of welfare food schemes in one country or another, in the assurance that we were thus at least reaching to the heart of the whole problem ? The argument is sound enough in theory ; the only question is how far it can be applied in practice.

There are obviously few countries even at the best of times, with such a superfluity of milk and other products, that they can link their welfare schemes with a surplus disposal policy. A fruit-growing country like Palestine may make some attempt at organizing such a scheme ; and in the course of the war both South Africa and New Zealand had been utilizing some of their spare fruit and other products for the feeding of their schoolchildren. But for most countries the opportunity is more limited. Where the foods selected for welfare purposes are not in abundant supply, the authorities have clearly no recourse but to some measure of priority allocation ; supplies have to be deliberatley witheld from the domestic consumer and directed to the schools, the welfare centres and so forth. This is quite practicable in the main ; and it had been the method used in the U.S.S.R. for some years before the outbreak of war. Let us assume, then, that a country gives evidence of its good intentions by promoting some scheme for the provision of welfare foods, but then finds its economy so backward and its population so depressed, that it is quite incapable of making the scheme work efficiently. What might the international organization do about it ? What, in brief,

should we propose as the right policy for the organization and its supporting governments to adopt ?

The answer is that the country might, in theory, import the food it requires in the form of dried milk and the like ; and naturally any country that did so could immediately deal with the imported supplies and retain them solely for the benefit of the *vulnerable groups* of its population. We have seen that small quantities of dried milk have already been imported into India partly for this purpose. But a poor country with a low export trade might have no margin to utilize for imports of this kind ; its whole balance might be absorbed in paying for its necessary imports of raw materials, machinery and manufactured goods. It is true that, as the world emerges into an epoch of common prosperity, even a depressed country might find itself with a reorganized and healthy agriculture and with prospects of a thriving overseas trade. It is the uneasy interval of transition with which we are concerned. The real question is whether in any circumstances the provision of welfare foods can be made an international responsibility. Can the more advanced countries of the world be induced to grant annual funds for the provision of welfare foods to remote and relatively unknown peoples ? To express the matter concretely, is it possible to make dried milk from Canada available to the pregnant mothers of Morocco, or butter from New Zealand available to the children of Nigeria or Ceylon ?

No universal plan of this kind has the slightest prospect of acceptance in the near future. For one thing there is too low a production of milk, dried fruit or cod-liver oil for a wide distribution ; and for another, the international organization has no common taxable basis, by means of which it can, for instance, arrange that Canadian taxpayers shall meet the charge of providing milk for Peruvian children. Temporary measures of relief may, of course, be covered, as at the close of a war, by funds granted by the relatively prosperous countries ; it is doubtful whether the process could be made to continue indefinitely. The schemes could, however, work within limited spheres. There is even much to be said for the granting of powers to the international organization to operate its own milk-drying and fish oil plants,

if it could offer backward countries a chance of acquiring supplies at production cost. Some attraction is needed to awaken the interest of poorer governments and persuade them to initiate schemes. There is little question but that an undertaking of this nature would help to mobilize medical and social support behind the international organization and would remove it from the limbo in which it at present seems to hang suspended.

There are, indeed, many parts of the world where we shall, for some years to come, have to improvize as best we can. The use of welfare schemes is only one of the many methods that could be tried. Where a pattern of poor feeding habits can be broken into at some point and fresh and more nutritious kinds of food introduced into the diet, the process of reform will at least have begun. The problems need the combined study of teams of sociologists, medical men and agricultural scientists. No very spectacular results may be forthcoming ; but to trace the pattern of food habits in all its complexity and to decide what practical reform first to initiate will frequently demand scientific qualities of a high order. Most of the diets usually consumed in our own colonial areas, for instance, are more or less defective ; and it is probably true to say that over much of the African continent we can only have recourse to indirect and partial methods of reform.

Among the peoples of Africa there are many traditional prejudices and tabus with regard to food, that have to be overcome or evaded. Some populations dwelling on the shores of lakes will not consume fish, even where their neighbours thrive on the food. In parts of Tanganyika a superstition prevents the women from eating eggs or drinking milk ; and in Uganda they are forbidden to eat chicken or mutton. In other areas of Uganda adult males may not drink milk. Such prejudices have doubtless in some instances had a reasonable origin ; milk, for example, is frequently a cause of disease in hot countries. But the tabus persist in spite of efforts to improve the processing and storage of food ; and it must be admitted, too, that there are still dietetic prejudices to be found even among those Europeans who have to administer the territory. Our own report on nutrition in the

colonial empire, which was published two months before the outbreak of war, has well remarked that ignorance and prejudice are not confined to those who are themselves undernourished. They exist also " among those who have power over the nutrition of others, government officials, members of Legislative Councils, employers of labour, education authorities and missionaries."

Let me quote the case of a survey carried out in villages of Nyassaland about the period of the outbreak of war. Women did most of the agricultural work and had, in addition, to spend on an average some 4½ hours a day pounding the maize, carrying water and collecting wood. Clearly the women had no time either to learn or to practice new methods of food preparation. It was ultimately proposed as a first step that a stone mill should be installed and that a miller might possibly be trained to prepare the meal. For the carrying of water it was suggested that cattle should be used ; and it was further pointed out that some some conservation of rainfall for irrigation purposes, could provide vegetables near at hand and thus save the time spent on collecting them from the bush.

Such methods, implying the training of craftsmen and the judicious use of appeals, will have to be employed among many of the native communities. It is strictly a process of instruction since the aim is rather to encourage a wider consumption of the foods that happen to be available. But it is no less necessary to make fuller use of the resources of the tropical soils and seas. For this purpose new processing plants would have to be installed ; and the primary aim is to decide precisely what plans would yield the highest dietetic returns in the shortest period. The tropical seas are certainly rich enough in fish with a good yield of liver oil ; and, on the other hand, the possibility of yeast culture on a large scale for the extraction of protein, has yet to be fully explored.

Both the schemes of instruction and those of installation will require considerable outlay, since teams of experts have to be provided and a study of natural resources has to be undertaken. There is here, as I say, a real basis for international collaboration ; and it is the extent to which such collaboration is practicable, that will show how far the international organization has rooted itself in the minds of men. It will

only do so in the measure to which the countries of the world begin to assume a global responsibility.

Chapter Thirteen

SOIL, SEAS AND PEOPLES

YET changes in the method of food production are already compelling a number of countries to come to agreements with one another ; and the pattern of these agreements, faint and irregular as it is at present, foreshadows the growth of a world organization. Conventions and treaties of this kind become indispensible, where it is a matter of safeguarding the very sources of the supply of human food.

The health of the soil is the common interest of all mankind ; it is, as I have said, our common heritage ; and in realizing this the initiative lies perhaps rather with the United States than with any other country. The United States did not need to learn from scientists that water and wind can remove bodily the surface soil of a whole region and render it entirely unfertile ; she learned it from bitter experience. Dust storms became in the 'thirties a feature of her normal life. In May 1934, for example, some three hundred million tons of soil were lifted in the Middle West by a single storm and blown towards the Atlantic seaboard. But while these disasters were followed in the States by drastic and often effective measures for conserving soil, it soon became evident that the countries of South America were by no means as conscious of the problem. Yet in many of these countries the fatal process is already at work, not least upon the steep upland slopes of Columbia, Equador, Peru and Bolivia. In Argentina the progressive ploughing up of grasslands has been accompanied by serious wind erosion ; and in 1937, the country experienced dust storms that were reminiscent of the Middle West. It was evidence of this kind that prompted the United States to summon a Pan-American Soil Conservation Commission, which met for its first conference on the third aniversary of the outbreak of war.

MAIN REGIONS OF SOIL EROSION
Darker shading indicates the areas most affected.
Equator

There is no reason to suppose that soil erosion in these countries has reached so advanced a stage as to call for immediate remedial measures ; but we probably have in the varied mosaic of South American farming almost every type of soil erosion. There is the pressure of population among the primitive communities upon the poorer soils of the mountain slopes, causing the peasant to depart from his traditional methods of conserving the soil ; there is the ploughing up of new grasslands without regard for the climatic conditions of the area ; and there is in Brazil the gradual stripping of forests along the Amazon with the increasing risk of water erosion. The farther the insidious devastation spreads, the greater the capital outlay needed for an effective policy of conservation ; and it is already doubtful whether some of the poorer countries are in a position to raise the necessary funds from their own resources.

Only where he has been in the habit for generations of practising methods that are suited to the needs of his own soil, does the individual farmer or peasant adopt naturally a system of cultivation that will not result in the slow degradation of the soil. Where the spread of plantations or of large-scale grain cultivation, has tended to drive back the primitive farmer or stock-breeder into reservations, or from the valleys and coastal plains to the poorer soils of the forest slopes, the traditional methods either break down altogether or are maintained in conditions to which they are entirely unsuited. Native reservations may lead, as in South Africa, to a gradual treading out of the limited pasture lands by the nomadic graziers. The sheltering forests of the slopes may be slowly cut away in the search for fresh cultivable soil, as they have been in parts of West and East Africa, until the rain torrents can pour down the slopes carrying with them soil and fertility and silting the river bottoms to overflowing. The individual peasant finds no immediate profit to compensate him for his losses either through reverting to his primitive methods of cultivation or through learning how to deal with so inordinate a problem by a painful process of trial and error. He needs capital ; and he must have some incentive to co-operate with his neighbours in dealing with a disaster that is common to them all. Pasture lands have to preserved from

over-grazing and systematically manured and re-seeded ; this is possible only by State assistance. Reforestation of the hill sides has to be undertaken on a wide scale ; and this can only be effective where it is accompanied by a more productive use of the soil of the lower slopes and of the valleys, so that the peasant's hunger for cultivable land may be in some measure satiated.

It is, as I have pointed out, in the areas of more recent civilized exploitation that erosion is most apparent. The settlers from Europe discovered lands that seemed to possess inexhaustible stores of fertility ; and they have cultivated these soils without comprehending the nature of the climates and the contours with which they were dealing. They have frequently disturbed beyond remedy the old communal habits of the primitive peoples among whom they settled. The soil has been almost literally *mined* for its fertility and that fertility has been exported in the form of produce to feed the increasing populations of Europe. The end result of the process is the degradation and denudation of the soil itself. It is said indeed that almost a million square miles of new desert have already been created in the world. The estimate may be exaggerated ; and what precisely it implies we need not pause to consider. We may take it as sufficient for our purpose that the soil of every country has obviously to be the concern of the world as a whole ; and in many instances only an international commission on the American pattern, prepared to authorize the investment of funds with no immediate prospect of return, will prove an efficient remedy.

When we leave the soil and pass to the deep sea waters, we reach a new element in our economic experience. Sea fishing is still in many respects like primitive hunting. The trawlers of several countries may meet in a common fishing ground, which they share as tribes of men may have shared common hunting grounds ; and where there is a rumour of abundant shoals of fish in a certain area, there comes inevitably a concentration about that area. Each trawler, each firm of trawlers, each country wants to have its share of the catch or more than its share. But stocks of fish and game are never inexhaustible. In the course of nature they will breed and replenish their numbers ; if the pressure of hunting or fishing

has been intense, especially upon the immature stock, the area will slowly be drained to exhaustion.

The seas may seen to fecundate with fish of many kinds ; and undoubtedly an acre of sea may be as productive in food as an acre of soil. But the immoderate process of fishing for haddock or halibut with the steam trawler has precisely the same consequences as the incessant exploitation of virgin soil. The returns gradually diminish. We have, in other words, to meet and solve the problem of the " over-fishing " of our common water. Ultimately the productiveness of the sea like the productiveness of the soil depends upon the available reserves of " plant nutrients " present in solution ; and these reserves are necessarily limited. So far as the vegetation upon the surface of the sea is limited by the supply of " plant nutrients " dissolved in the water, the fish life in the sea is also limited ; and where the market for white fish or herrings becomes virtually unlimited, trouble is bound to follow.

Now, the herring fisheries in the North Sea and the cod fisheries off Newfoundland seem still to be yielding large catches, even apart from the temporary suspension of fishing in some areas during the war. But by the outbreak of the war the catch of cod in the North Sea was on the decline ; and there is evidence that the intensity of fishing for haddock had in the last decade carried the industry beyond its level of profitability and that the stocks were becoming seriously depleted. The same process has been at work in the prawn fisheries off the coasts of Norway ; by 1933 the prawn fishers were extending their operations into fresh grounds and in all the older grounds stocks were diminishing. No one can doubt that in a matter of this kind some international agreement is necessary. The waters off the western shores of Europe are fished by the trawlers of at least ten nations ; and the immediate solution is obviously to regulate by common consent the size of the mesh that should be used. It may not always be the best plan to leave all the small fry and catch only the larger and more mature fish ; to thin the sea out a little at times means that the survivors find more food and so reach a fair average size. But scientific fishing of this nature is difficult to organize among a large number of trawler owners ; and the

more practical method is simply to forbid the use of small-mesh nets, so that the immature fish have a better chance of surviving and breeding. In 1932 our own country took the lead in regulating the size of the mesh ; and in 1934 the International Council for the Exploration of the Sea, a body that had been established early in the century, recommended to all the countries concerned that similar regulations might usefully be imposed upon their fisherfolk. Three years later a convention was signed by ten nations.

But is it sufficient merely to regulate the size of the mesh ? If an increase in the number of fish only leads once again to a period of more intense fishing, will not " over-fishing " result even with the use of large mesh nets ? That is true enough. Where, however, a still more drastic control is imposed upon the fishing communities, a fertile fishing area can clearly be held at a constant level of productivity for many years. To maintain a steady level of yield from the fishing grounds, it is necessary to control the absolute amount of fish that may be taken in any given year. Otherwise the market, which may be virtually insatiable, will drain the seas to exhaustion.

There appears so far to have been only one attempt to control fishing to this extent. The halibut fishery off the western shores of Canada and the United States started in 1888 ; but it was not until 1910 that the use of improved gear had depleted the inshore banks to such an extent that the trawlers were compelled to work far up and down the coast and into the deep waters of the Pacific.

By 1932 some regulation of the industry had become indispensable ; and an agreement between the two countries concerned allotted to each the precise quantity of halibut that might be landed in any single season. The result of this agreement has been gratifying ; stocks have increased and been maintained at a profitable level. It has meant the restriction of the fishing season to a matter of five months or so ; but how the problem of " over-fishing " can be dealt with except by some such measure of control, it is difficult to see.

Now that the war is over, the catches will for a time be heavy ; but they will not remain heavy. The North Sea catch

in 1919-20 was remarkably good ; it soon began to fall off towards the pre-war average of about 430,000 tons a year. We had at that time a chance of stabilizing the yield by international agreement, but the chance was neglected. Had it not been for the opening up of fresh grounds in the far northern waters, our supplies of white fish might by the late 'thirties have become inconveniently small. It is high time that the eastern waters of the Atlantic were surveyed and scientific control over them established. The northern waters of the Pacific probably need similar treatment. The Japanese had already before the war exhausted the yield of their inshore waters and were beginning to range further afield for their catch. The Soviet fishing industry has expanded considerably since the 'thirties ; and if to these there is added a thriving Chinese industry, the demand for fish in the markets of north-eastern Asia is likely to exceed anything we dream of in the west.

How far humanity can ever hope to subsist upon the harvest of the seas must be matter for surmize. A limit seems to have been imposed by nature. Only in narrow waters that can be prevented from mingling with the main waters of the ocean is it possible so to increase the supply of fertilisers as first to increase the yield of the vegetation and ultimately to raise the number of fish. We cannot yet manure the seas ; and we have to realize that the distribution of " plant nutrients " such as phosphates and nitrates in the sea is very uneven, depending as it does upon the movement of currents of water that force reserves from the depths towards the surface. For this reason, so far as we can understand the process, there is a heavier concentration of fish in the northern waters. Newfoundland, for example, has an annual catch of cod amounting to some 350,000 tons ; yet the waters show few signs of " overfishing." On the other hand, the tropical seas vary little in temperature from season to season ; and the dissolved nutrients near the surface remain more or less at a constant depth and are not replenished by fresh reserves forced up from below. In such waters there are many species of fish ; but their total numbers are relatively small. Yet, for all that, we know little of the possible yield from the fishing grounds off Bengal and Madras ; it is said that less than 5 per cent. of the

grounds available off Madras have been exploited and that by primitive methods of fishing. All we do know is that the fishing off the Phillipines and a few of the other islands is sufficiently remunerative to make fish an important item in the native diet.

We are moving here, scientifically speaking in very deep waters ; and of the cold southern seas of the world we probably know even less. The seas of the world like its soil provide a vast field for scientific enquiry that cannot in the nature of things be undertaken by one country alone. The further we go, in fact, the more we find ourselves forced towards international co-operation.

Chapter Fourteen

FOOD AND THE HUMAN RACE

IN man's relation to the soil and to the seas there are two opposing trends that have been implicit throughout this story of the insatiable human stomach. The earth has still vast powers of increased food production ; yet there is at the same time a limit to the productivity of any climate, soil or sea. It still remains true of agriculture that we can only subdue Nature by obeying her laws. The sciences of irrigation, soil management, animal selection, pest control and food preservation will unquestionably help us to double the food yield in many regions of the world. But the *population* of the world is still increasing.

Will the growth of population at some stage outstrip the food supply ? The problem is in part a regional one ; though we may think of the world as a great farming area, there is a limit to the possibility of shipping food from continent to continent. The overseas countries are less inclined than ever to remain mere food-producing territories, exporting much of their products to the concentrated centres of industry. They are developing industries of their own. The world is nearer

a common pattern in this respect than it was thirty years ago. Moreover, it is surely our aim through scientific farming methods to cut down the labour force needed in the daily production of human food ; and where would be the gain if we only had to increase the labour force daily engaged in transporting tons of food from area to area ? Is it not preferable that in every country industrial and farming communities should be closely interwoven, drawing some spiritual vigour and inspiration from their social merging ?

Viewed in this way, the problem is especially acute in eastern Asia, which contains, as we have seen, at least half the human race. It is a world within a world. In many other countries the poorness of the average diet gives most of the inhabitants a low expectation of life. But in the countries of eastern Asia it is only too clear that numbers can still increase in spite of the prevailing poverty. All the average woman need do to ensure this increase is to bear three or four surviving children and die. In other words, it is possible for an increased food supply to result in nothing more than a few million extra malnourished human creatures. If the growth in population is constantly keeping pace with the growth of food resources, all we are achieving is to arrange that a yet larger number of men and women shall live miserably and die before their time.

Obviously the social laws of human diet are not the same as the laws of Nature. The idea that a man must be *well* nourished to become completely *man* does not enter into the scheme of Nature. Nature is concerned merely with keeping him alive till he can breed. The concept of making a race of supremely well-fed men and women is entirely human in its origin. It means that we break with the natural law of growth and decline, and that we apply the social law, which reckons only in terms of biologically complete men and women. There is no way of applying this law but that of inoculating the people with a sense of the value of individual life. Let us have no illusions about it. The eastern countries are civilized countries where health services and infant welfare schemes are in the air. As such services begin to expand, the rate of survival will rise ; and for a time the population will increase more rapidly than ever. Yet even under most uncivilized conditions of

medicine and welfare the populations had persisted in their increase ; and apart from the unthinkable recourse to a famine or a plague of overwhelming proportions, there will be no diminution in the rate of growth. A famine that claims ten million Chinese victims is a horrible event ; but it scarcely influences the growth rate in a population of four hundred million.

Is it then true that, as their standard of living improves, people trend to breed more slowly ? If this were undoubtedly a social law, the sooner we raise the standard of living in the East, the better for all concerned. It would, in fact, be our only remedy. We cannot, however, argue from the experience of the western countries to Indian or Chinese conditions. There are too many variable factors of tradition, custom and human type. All we can safely say is that we *have* to try the path of social reform, because there is no other path open to us ; and since social reform has its educative aspect, it naturally carries with it some prospect of inducing men and women to control the number of births.

I would not have it supposed that the high rate of mortality both in many of these eastern countries and elsewhere in the world, is due solely to a poor diet. Some writers have tended to underestimate the value of a good varied diet ; but others have claimed far too much for it. Apart from the obvious cases of partial starvation and malnutrition, we still find it difficult to define precisely what benefit the body derives from an ample mixed diet over a term of years. Its effects are perhaps rather dynamic than substantial, though no one will deny that it is a necessary part of the foundation of sound bones, teeth and organs. It is manifested in the alertness of the body, in self-assurance and stamina, in a heightened appreciation of the savour of life.

Yet there is a remarkable parallelism between the diet of various peoples and their average expectation of life ; the poorly fed peoples show consistently a high rate of infant mortality. It is worth while to compare in the following table the mortality rates of certain countries with the proportion of cereal foods they consumed in their diet. The year taken is 1938 or the nearest year for which figures are available.

TABLE 3

VITAL STATISTICS FOR VARIOUS COUNTRIES
(1938 OR NEAREST APPROX. DATE).

Country	*Percentage of potatoes and cereals in the total diet*	*Average expectation of life in years*		*Infant mortality rate per thousand live births*
		Males	*Females*	
Australia . .	30–39	63·48	67·14	38
New Zealand .	30–39	65·04	67·88	50
United States (Whites) . .	30–39	60·6	64·5	51
Canada . . .	30–39	58·96	60·73	63
Britain . . .	30–39	60·18	64·40	55
Norway . . .	40–49	60·98	63·84	37
Germany . .	40–49	59·86	62·81	60
Netherlands .	40–49	65·1	66·4	37
Hungary . .	50–59	48·27	51·34	131
Czechoslovakia.	50–59	51·92	55·18	121
Belgium . .	50–59	56·02	59·79	73
France . . .	50–59	54·30	59·02	66
Bulgaria . .	70–79	45·92	46·64	144
Poland . . .	70–79	48·2	51·4	140
Japan	70–79	46·92	49·63	114
India (British) .	80–89	26·91	26·56	167

These figures only mean, of course, that people at a low standard of living are usually *also* subsisting on a poor diet. But precisely how far the poor diet contributes to the high death rates, no one could say. What we can say, however, is that under these conditions a large proportion of those who manage annually to survive are low-grade specimens of humanity. The high death rate is merely the extreme evidence of social poverty.

In brief, if it is our ultimate aim to fill the world with vigorous, healthy, long-lived people, then the only substance from which we can build them is their food. Heredity may

account for more than a little ; but even the best strains are unable to overcome the handicap of a consistently poor diet. In any case, it will take longer to persuade mankind to improve its breeding habits than to persuade it to manage its larder.

It has been for this reason necessary to concentrate first upon the heavily populated areas of the East. There are no comparable problems of food production in the great regions of North America or of the U.S.S.R. Between them these areas contain about 18 per cent. of the human race ; and while they may be faced with a certain number of technical and economic problems, the pressure of population upon the sources of food supply is not one of them.

On the food economy of the U.S.S.R. I have scarcely touched at all and I suppose it will be obvious that the omission is a deliberate one. The Soviet solution is quite effective ; and it is clear, moreover, that such conclusions as may be drawn from it are beginning to influence the thoughts of men in a number of countries, especially among the Indians, the Chinese and the peoples of eastern Europe. Undoubtedly Soviet experience will help to mould the course of the farming revolution in these countries to a greater or less extent. But the rest of the world has not yet been affected by the farming practice of the U.S.S.R. ; and in seeking to feed the human family science has to adapt itself to the political and economic conditions it finds in existence. I have simply assumed that for the greater part of the world social and commercial institutions as we know them to-day, will have to be somehow transformed to serve our dietetic ends.

But we shall gain nothing by supposing that the process will be an easy one. Ingrained farming and commercial habits of thought can set up a viscous type of resistence that slows down the rate of reform. I might as well say at once that in my view there will have in several countries to be a large measure of State intervention in the field of wholesaling and food manufacture. Where there is a market for food of any size, there is always a sequence of transactions taking place between the producer and the consumer ; and it is not the slightest use to assist the producer in lowering his costs, if wholesalers and manufacturers are going to raise their prices or restrict the flow of food on to the market, in order to reap

the profits of an artificial scarcity. Both the producer and the consumer will suffer. Yet such restrictions in the flow of food on to the market are bound at times to occur, unless wholesalers and manufacturers are induced to work on an expanding output with diminishing costs. They must, in other words, agree to the principle of a large market with small profits per unit, rather than high profits per unit on a restricted market. I fail to see how this is to be achieved unless the State intervenes to impose an ethical code upon the commercial interests. How far some governments will come ultimately to manage such processes as flour milling, margarine manufacture and milk distribution, we can leave to the movement of events.

Before we can safely release the fertility of our soil, we have thus to remove all possible barriers to the free flow of cheap foods on to the market. When we are fairly certain that such barriers are being removed, we can turn to the increase of farming efficiency and the development of peasant co-operatives. Here again some government intervention will frequently be needed. For the purchase of farm equipment and fertilizers, for instruction and for the efficient marketing of produce from the villages, an elementary knowledge of book-keeping and farm management is required ; and this is often so lacking among peasant communities that their own efforts at co-operation are short-lived or frustrated by mismanagement and corruption. Even in the relatively advanced food-producing countries such as New Zealand and Denmark, the success of the great butter making or bacon curing co-operatives with their large export markets is in reality ensured by some kind of partnership with the State. In brief it has become scientifically impossible nowadays to look for the expanded food production we need, unless we grasp the fact that the State and the community are not two opposing things ; they are merely two aspects of the one thing and must become more fully merged into one another.

As I have shown, it is equally true that for a well-fed world we must have co-operation between all the countries affected. The movement towards an international food organization emerged from the increasing complexity of the world food market ; and the task of the organization is to increase in some respects the interdependence of the various countries,

GROWTH OF THE POPULATION OF INDIA

DATE	POPULATION		
1872	203	MILLION	
1881	250	MILLION	
1891	279	MILLION	
1901	284	MILLION	
1911	308	MILLION	
1921	306	MILLION	
1931	338	MILLION	
1941	389	MILLION	

until the pattern of a common economy begins to reveal itself. Even on the purely technical side we are forced into co-operating, in soil conservation, for example, in fisheries, in pest and disease control, in the establishment of common standards of purity, in large scale schemes of electrification and irrigation. Where the free movements of food and measures for the prevention of famine are concerned, the need for an agreed policy is even more obvious. One may add that our own country of all countries seems least able to take chances in this respect.

I began this chapter with that world within a world which is the Far East, the home of half the human race. We also are a strange isolated world within a world, though we account for little over 2 per cent. of mankind. We are so dependent upon food from overseas that the slightest disturbance of world supplies affects our food economy. Thus when in 1946 the failure of the Indian rice harvest led to the retention within the country of a large proportion of the crop of oil-bearing nuts, our fats ration could no longer be maintained at its old level. It becomes quite clear that once the standard of living in India is raised perceptibly, much of the present yield of oil-bearing plants will be permanently processed in the country itself for home consumption. Again, we have to realize that under existing conditions of soil and water supply the production of butter and meat in Australia and New Zealand cannot be expanded much further ; and if the policy of these countries leads to an increase of the population by 30 per cent. or so, more food would have to be retained on the home market. These movements in world food economy may be slow ; but they will gradually make themselves felt.

The rule is that a high importing country must encourage high levels of food production overseas unless it is absolutely sure that its own economic and political position will enable it to attract to its shores all the food it requires. Economically we are no longer in that secure position ; and we know that unpredictable changes are taking place in many parts of the world. Every move to raise the standard of living in a backward area means in the early stages that the area concerned will be growing more food of more varied kinds for its own consumption and will be developing a few minor industries.

Its labour ceases to that extent to be *colonial* labour for the production of food or raw materials. So far as this process continues, the only remedy is to apply scientific methods to the cultivation of the industrial and food crops needed by the imperial country, oil seeds, for instance, or sugar, or cocoa, or rice or tropical fruits. Moreover, if on the one side you encourage the growth of small native industries and native farming, you must on the other offer a good and a stable price for export food products ; you will otherwise find that the native farmer has less and less interest in cultivating crops that yield him only a low and fluctuating return.

For a heavily importing country like our own the more overseas farming begins to assume new patterns and adopt new markets, the further the process has to go. It becomes positively dangerous to hold it up ; and the process is already at work. In other words, the policy of the new international food organization and our own national interests are strictly identical. We should by all means continue to develop at home such services as the provision of milk to pregnant women or meals to schoolchildren ; in the whole field of food distribution there is much room for experiment. Our home farming, too, needs measures of reorganization that are rather beyond the scope of this book. But when we speak of our " farm," we must not forget that it strictly includes the cultivated soil of Jamaica, Nigeria, Uganda, Borneo and several other countries. These countries are still controlled from our Colonial Office ; and if we want to ensure the bases of some of our normal food supplies we had better treat the soils and the folk who cultivate them with the respect that all farming land and farmers deserve of their governments.

But there is one thing that needs saying. If common sense demands that we take an interest in the cultivation of colonial soils, I am not sure that common decency does not give us some responsibility for the right feeding of colonial stomachs. Is there any valid reason why school meal schemes should not be planned as much for the children of Ceylon or Trinidad as for the children of Britain ? They all still belong to a single commonwealth. After our long survey of the human larder we come in full cycle again to the craving insatiable stomach. But we are not thinking now of the

stomach of an individual man ; we see this as no more than a unit among the millions of human stomachs, that together compose the daily hunger of our species.

The food physiologist is compelled by his trade either to accept the universal brotherhood of man or to deny his own conclusions. Whatever differences there be between the different types of mankind, it is absolutely certain that the Bantu or the Burmese or the Peruvian has about the same size stomach as the average Londoner or New Yorker. Upon this universal stomach is built ultimately the whole of human civilization. If it is to be a democratic civilization it must be built on the recognition of the common needs of all men.

We have reached the stage in human history where we command vast reserves of unused scientific knowledge. It was the great Hopkins who remarked in the course of a meeting that through the success of scientific methods it had now become possible to repeat the miracle of the loaves and fishes. A moment or two later he added that society seemed to be content that the loaves only should be fed to the multitudes, while the fishes, which were even more essential to health, were forgotten. How far this is true, each of us must judge for himself. But beyond question, if we have now arrived at the age of universal miracles, we had better begin to admit in the humblest dietetic terms that man does not live by bread alone.

Chapter Fifteen

CONCLUSION

TO conclude by summarizing all that I have said is probably beyond my power. Any study of the science of world feeding, in our present knowledge of the subject, must be less a textbook than an incentive to further research. Let me, however, attempt to leave some pattern in the reader's mind.

The fact that the organism requires heat, moisture and oxygen for its survival need not disturb us unduly. There

seems not the remotest prospect that the free supplies of air, water and solar energy will fail us for millions of years to come. Food is another matter. It can only be secured by unremitting labour. Men may cease to be hunters and food gatherers and become cultivators of the soil ; they may progress from primitive cultivation to the tractor, the combine harvester and the irrigation dam. The price they have to pay for their food is still eternal sweat, forethought and vigilance.

We are, moreover, growing very conscious of ourselves as a planet. Upon the limited soil of this planet we have to produce the food for an increasing population. There is no chance of importing supplies from Mars or the Moon. We might as well face the problem calmly and agree that we have of late years made an unholy mess of our solutions.

The fault does not lie with the producers of food, who are a vast dispersed multitude of farmers and peasants. The fault lies rather with ourselves as social beings, in that we have given too little attention to what our scientists and economists were attempting to tell us. Scientists and economists as a class have no desire to dictate the course of national or international policy ; but the wisest among them would at least like to see a deeper appreciation of science infused into the minds of our statesmen and administrators.

That is perhaps the essence of the whole matter. We should by this time be thinking of food production and food distribution in the world as problems in good management ; and many of our statesmen are obviously still thinking of them in terms of 19th century nationalism or imperialism. I have for this reason attempted in the final chapters of this book to define the tasks that seem to lie immediately ahead. Let me restate them and make a few further comments.

We have clearly to look to the condition of our soil in many parts of the habitable world. The damage done to it in a hundred years of wasteful cultivation is wide and progressive. Moreover, the problems of flood control and irrigation will have to be handled on the grand scale if we are to make sure of reaping the crops we need for our increasing population. No less necessary is it for pest control and the control of plant diseases to be undertaken through measures of international co-operation. These are all problems of good

management. We are dealing, it must be remembered, with the forces of nature ; and nature knows nothing of the arbitrary lines of frontiers, zones and spheres of political interest.

At the other extreme we have the medical problem of ensuring that poorly nourished peoples and depressed classes of the community have a chance of a better diet. This belongs to the field of what has been termed applied or social nutrition. Often we have to work under conditions that are far from favourable. Not only have administrative difficulties to be overcome, but traditional tastes and prejudices have to be modified through a slow process of education. The problems are, however, quite as interesting as those of soil conservation or locust control ; and accumulatively the solutions we apply are already having a beneficial effect upon the health of many communities.

We are left with two very significant and, as it happens, inter-related problems. One of them is the movement towards agrarian reform now manifest in the backward farming economies of the world ; the other is the *malaise* that now haunts the farming economies of most of the great food-exporting countries overseas. The two problems are vitally inter-related because they are a part of the profound conflict of ideas and solutions that is troubling the modern world. I mean that in many countries (in the south-eastern regions of Europe, for example, in India and parts of China and in several of our own colonies) we seem to be witnessing the first stages of a vast agricultural revolution that will, in time, be as overwhelming in its effect as was the industrial revolution of a century and a half ago. The process may be a slow one, but it will be none the less sure. The task of the scientist is to accelerate this process by all the means within his power. But the fact of the matter is that the statesmen responsible for the guidance of this vast process of reform are, in the main, anxious lest its course in the various countries should be disturbed by the impact of world crises and depressions, at a time when the reforms themselves need to be carefully and sensitively fostered. They are probably correct in their judgment ; the trouble is that they have a natural tendency to insulate their economies from the influence of the world

market ; this itch to have some temporary release from the disturbing effects of world fluctuations is clearly evident both in the eastern countries of Europe and even in the trend of our own imperial policy.

On the other hand, the natural preference among the large overseas exporting countries is for a world where the foodstuffs they produce can be freely marketed ; and their economists tend at times to think of the free movement of commodities as the sole criterion of a prosperous world economy. It is desirable, no doubt, to progress towards that goal ; the real problem is how long it will take to reach and by what varied paths we shall ultimately reach it. The United States, as, to some extent, the spokesman of these exporting countries, acts at times as though she would like to mould much of the world into an economic pattern, that is, in effect, an extension of the internal economy of America.

Unfortunately the economy of United States is essentially an unstable one and is subject to precisely that alternation of booms and depressions that many other countries are anxious to avoid. Hence the conflict of interests that expresses itself in relation to the theories of international trade, of the disposal of surplus products and of the degree of financial support that shall be accorded to the struggling economies of backward countries. The idea of a world patterned after the image of American economy does not appeal to the possibly more realistic governments of the Danube Basin or of the U.S.S.R., whose statesmen have learned something about the technique of managing prices and markets within a rapidly evolving economic system.

Later on, of course, as the new farming economies in the Old World begin to mature, they will provide a useful market for overseas food and feeding stuffs. But they must in my view be given time to mature. That is the true path towards a practical internationalism. One can blame neither the U.S.A. nor the U.S.S.R. for maintaining and propagating their own theories of solution for our food problems. The U.S.A. must, however, see the reasonableness of a slow rate of progress ; for, if she does not, her great military power will only tend to intensify the fears of the Old World ; and the end result may be catastrophe.

It is necessary thus to interpret the conflict within the world to-day in terms of the world's food ; and we must, I think, realize that the only immediate solution, that has any practical validity, would be the establishment of some kind of surplus disposal board. As I write the problem is under consideration ; and whatever be the decisions taken, only the passage of time will show whether such a board is fully acceptable to the nations of the world. Meanwhile, our own duty as a nation seems tolerably clear. We are a high food-importing country ; and any disturbance in the levels of world production tends to affect the pattern of our daily diet. We must take the *scientific* course of encouraging good soil and stock management in every area in which we have some measure of control and responsibility. There is, for example, enough to be done in reforming African farming economy to occupy us for a generation.

Let us all, in brief, cultivate our own gardens and attempt no short cut towards a specious internationalism. Let us by all means enter into any form of international agreement that seems practicable. But let us be tolerant towards countries that appear to be bent on pursuing their own plans of farming reform. From it all there will at last emerge the ideal of one world, one farm, one market. In the interval we must be cautious. Man may come finally to inhabit a garden as fruitful as that from which he was fabled to have sprung. But for the moment our mastery over the statistics of food production, like our mastery of the atomic nucleus, is too painfully like the fruit of that legendary garden of old ; it is pregnant with the foreknowledge of good and evil.

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Appendix

A SERIES OF ADDITIONAL TABLES

A few illustrative tables may be added. The first is a useful record of the estimated populations of the different continents.

TABLE "A".

POPULATION OF CONTINENTS AND PERCENTAGE OF WORLD POPULATION.

Continent	*Population (In Millions)*	*Approximate Percentage of Total*
ASIA	1,154	53·0
EUROPE	575	26·5
NORTH AMERICA ..	184	8·5
AFRICA	157	7·5
SOUTH AMERICA	89	4·0
OCEANIA	11	0·5
TOTAL	2,170	100

It must, however, be realized that at present a very small and somewhat variable proportion of the continents is under crops. A large proportion of the land surface is covered with mountains, with hills that are only partially cultivable and with plateaux of varying and often negligible fertility. Table B. shows the approximate proportion of the continents at present under crops.

TABLE "B".

APPROXIMATE AREA OF EACH CONTINENT UNDER CROPS.

Continent	*Percentage of Land under Crops*
ASIA	5·0
EUROPE	20·0
NORTH AMERICA	6·0
AFRICA	2·5
SOUTH AMERICA	2·0
OCEANIA	1·5

What proportion, then, of the continents is suitable for cultivation? The proportion is not large; but with our present methods and our present knowledge we might extend the cultivated area about as far as is

Appendix—*continued.*

indicated in the following table. Much of the new land might be low yielding ; and no doubt we could achieve more by good manuring and by selection of seeds on the land already under cultivation.

TABLE " C ".

PROPORTION OF CONTINENTS SUITABLE FOR CULTIVATION.

Continent	*Proportion*
ASIA	6—10%
EUROPE	35—40%
NORTH AMERICA	10—15%
AFRICA	3—10%
SOUTH AMERICA	5—10%
OCEANIA	3—.6%

In the densely populated and the poorer soils little space can be spared for pasture, or grain for the feeding of live stock. As a consequence, some of the continents are relatively poorly provided with foods of animal origin ; and this, as illustrated in Table D. gives an indication of the varied dietetic levels at present in existence.

TABLE " D ".

PROPORTION OF HUMAN ENERGY DERIVED FROM ANIMAL FOODS IN THE VARIOUS CONTINENTS.

Continent	*Percentage of Animal Food in Total Food*
ASIA	3
EUROPE	17
NORTH AMERICA	25
AFRICA	4
SOUTH AMERICA	16
OCEANIA	36

As I have pointed out, there is a great variation between one country and another in the proportion of their inhabitants engaged in agriculture. In many countries there is insufficient industry and the soil is too over-

Appendix—*continued.*

crowded for good farming. The two following tables give some evidence of the variation between countries, both on the European and on the American continents.

TABLE " E "

PROPORTION OF POPULATION OF EUROPEAN COUNTRIES IN AGRICULTURE.

Country	*Rural Percentage*
BELGIUM	17·0
NETHERLANDS	20·6
FRANCE	34·5
HUNGARY	50·8
POLAND	66·0
BULGARIA	80·0

TABLE " F "

PROPORTION OF POPULATION OF AMERICAN COUNTRIES IN AGRICULTURE.

Country	*Rural Percentage*
U.S.A.	23·0
CANADA	45·0
CHILE	50·0
BRAZIL	65·0
MEXICO	65·0
PERU	90·0

Meanwhile poor manuring and the use of unsuitable land has meant a relatively low yield of crops per acre in several countries. There is no doubt that yields could be much increased by good cultivation, even in some of the more advanced countries. The improvement in the backward countries would be proportionately greater. Table " G " compares the wheat yields per acre during the 'thirties in a number of countries.

Appendix—*continued.*

TABLE "G"

YIELD OF WHEAT IN CWTS. PER ACRE.
(1930—1934)

Country	*Cwts. Per Acre*
RUMANIA	7·1
YUGOSLAVIA	8·0
BULGARIA	9·2
GERMANY	17·1
GREAT BRITAIN	17·8
HOLLAND	23·0

In addition, the need to produce crops for human consumption and the poor pastures have meant that in many countries a relatively small number of live stock can be maintained on a given area of farm land. This is illustrated in the following table.

TABLE "H"

NUMBER OF LIVE-STOCK PER HUNDRED ACRES OF FARMLAND—(1934).

Country	*Cattle*	*Pigs*
RUMANIA	10	7
YUGOSLAVIA	11	9
BULGARIA	13	8
GERMANY	26	33
GREAT BRITAIN	26	7
HOLLAND	41	35

In the more advanced countries, however, the food of the people has become more varied and wholesome. Milk, for example, was being, down to the period of the war, more regularly consumed. The numbers of the dairy cows increased not only absolutely but proportionately to the total numbers of cattle maintained. We can observe this tendency below.

Appendix—*continued.*

TABLE "I"

PROPORTION OF DAIRY COWS IN TOTAL HERDS OF CATTLE

Country	1913 %	1933 %
AUSTRALIA	18·0	24·3
CANADA	41·2	42·3
DENMARK	53·2	56·5
FRANCE	52·7	54·2
GERMANY	53·9	56·8
UNITED KINGDOM ..	38·7	42·2
UNITED STATES	36·7	38·6

So with the production of eggs, another of the more wholesome and palatable foods. Most of the western countries had been steadily increasing their production of eggs down to the outbreak of war.

TABLE "J"

PRODUCTION OF EGGS.
(*In Millions*)

Country	1913	1934
BELGIUM	960	2,070
DENMARK	796	1,478
GERMANY	4,100	6,200
GREAT BRITAIN	1,121	4,058

The result was that the consumption of eggs per head of the population was relatively high in a number of countries, while in some of the poorer countries consumption per head was less than half that in more prosperous communities. The same type of comparison could, of course, be made with other animal foods.

Appendix—*continued.*

TABLE "K"

YEARLY AVERAGE CONSUMPTION OF EGGS PER HEAD IN VARIOUS COUNTRIES—(1930—1934).

Country	*No. of Eggs*
CANADA	285
NEW ZEALAND	240
BELGIUM	236
UNITED KINGDOM ..	172
FRANCE	149
ITALY	119
POLAND	110
RUMANIA	110
AUSTRIA	98

Not only have many of the countries of western civilization been increasing their production of animal foods ; they have also been reaching out to acquire varied foodstuffs from the tropics. Especially in the last fifty years have they been increasing their import of vegetable oils. First, in Table L we see the proportion of the world's supply of vegetable oils produced in the different continents.

TABLE "L"

DISTRIBUTION OF WORLD PRODUCTION OF VEGETABLE OILS.

(AVERAGE 1935—1937)

Continent	*Percentage*
EUROPE	10·7
U.S.S.R.	10·4
NORTH AND CENTRAL AMERICA	12·5
SOUTH AMERICA	9·0
ASIA	42·7
AFRICA	13·4
OCEANIA	1·3

Appendix—*continued.*

Thus Europe and North America have both been producing some vegetable oil, between them perhaps 23 per cent. of the total yield. But they have also been absorbing much of the yield from the tropical countries. About a third of the total world production passed into world trade ; and the following table shows which of the countries were receiving it and in what proportions.

TABLE " M "

PROPORTIONATE SHARE OF WORLD TRADE IN VEGETABLE OILS

(1936)

Country	*Percentage of Imports to various countries. Total World Trade* 3,460,000 *Tons*
GERMANY	18·5
UNITED KINGDOM ..	16·5
FRANCE	15·0
REST OF EUROPE	17·5
U.S.A.	25·0
JAPAN	3·5

The same might be said of several other tropical products, such as fruit. Take bananas, for example. Most of them were shipped before the war to western Europe or the United States, as the table reveals.

TABLE " N "

PROPORTIONATE SHARE OF WORLD TRADE IN BANANAS

(1938)

Country	*Percentage of Imports passing to various countries Total World Trade* 2,500,000 *Tons*
UNITED KINGDOM ..	12
FRANCE	7
GERMANY	6·5
REST OF EUROPE	5
U.S.A.	53
ARGENTINA	6·5
JAPAN	5

Appendix—*continued.*

Our own country, as we have seen, is a very high importer of food. The proportion of many of the foods imported is now lower than it was in the pre-war years; but the change is not very marked. The following figures summarize the position as it stood in the late 'thirties.

TABLE "O".

British Food, Percentages Home Produced and Imported

(Pre-War)

Foodstuffs	*Percentage Home-produced*	*Percentage Imported*
Wheat, etc.	12	88
Fats	7	93
Sugar	18	82
Meat and Bacon ..	45	55
Fish	85	15
Eggs	60	40
Liquid Milk	100	—
Cheese	24	76
Potatoes	94	6
Fruit and Tomatoes..	26	74

On what a number of countries we have been depending for these imports may be seen from the final table, which shows the proportions of imports we received from the main producing countries with whom we traded.

TABLE "P"

Main Sources of British Imports of Food

(1934—1939)

Commodity	*Wheat*	*Feeding Stuffs (Maize, Etc.)*	*Meat and Bacon*	*Vegetable Oils*	*Dairy Produce*
Main Sources of Supply and Percentage of Total Imports of each Food	Canada (39) Australia (24) Argentina (15)	Argentina (57) India (11)	Argentina (32) Australasia (32) Denmark (13)	Egypt (24) India (20) W. Africa (18)	Europe (45) Australasia (39)

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